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AGRICULTURE: LAND AND LIFE

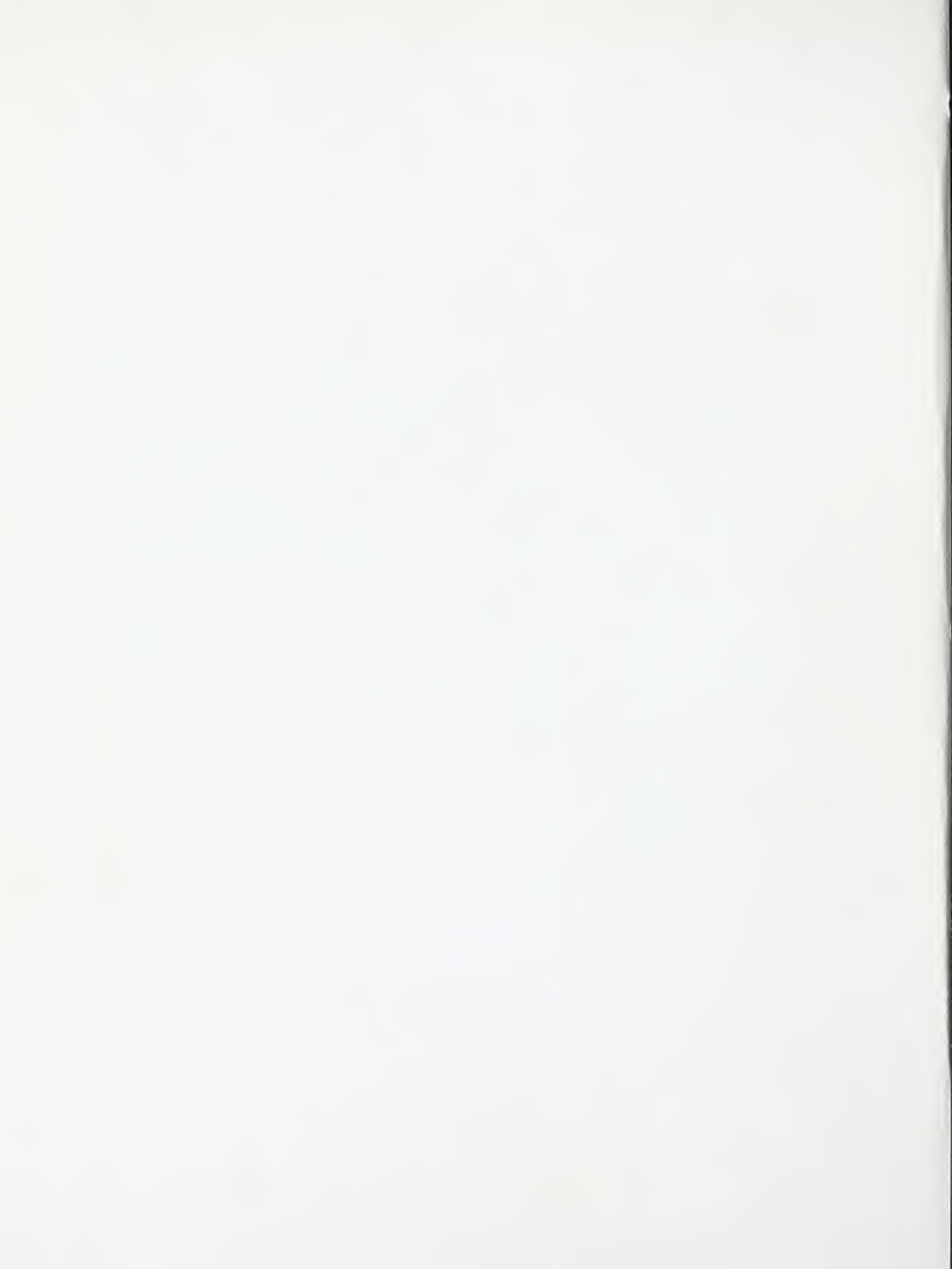
Year Two/Modules 1-4

Learning Facilitator's Manual



Distance
Learning

Alberta
EDUCATION



SEP 15 1992

Agriculture: Land and Life Year Two

Modules 1 – 4

LEARNING FACILITATOR'S MANUAL



Note

This Agriculture: Land and Life Year Two Learning Facilitator's Manual contains answers to teacher-assessed assignments; therefore, it should be kept secure by the teacher. Students should not have access to these assignments until they are assigned in a supervised situation. The answers should be stored securely by the teacher at all times.

Agriculture: Land and Life Year Two
Learning Facilitator's Manual
Alberta Distance Learning Centre
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The Alberta Distance Learning Centre is dedicated to upgrading and continually improving your learning facilitator's manual so that it accurately reflects any necessary revisions we have had to make in the student module booklets or the assignment booklets. The types of revisions that will be made are those that make the course more accurate, current, or more effective.

The ADLC will send you the latest enhancements and upgrades for your learning facilitator's manual if you return the following registration card to: Alberta Distance Learning Centre, Box 4000, Barrhead, Alberta, T0G 2P0, Attention: Design Department.

ADLC Learning Facilitator's Manual Registration Card

First Name

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You can help ensure that distance learning courseware is of top quality by letting us know of areas that need to be adjusted. Call the Alberta Distance Learning Centre free of charge by using the RITE line and ask for the Editing Unit. Also, a teacher questionnaire has been included at the back of most learning facilitator's manuals. Please take a moment to fill this out.

We're looking forward to hearing from you!



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Introduction

A survey of these course materials will confirm that this new learning package has been specially designed for many kinds of teachers working in a variety of situations.

Which Category Do You Fit?

☐ Small Schools Teacher

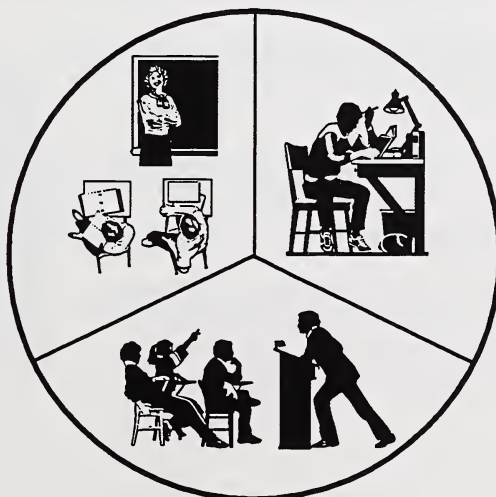
- ☐ inexperienced
- ☐ experienced, but in other subject areas
- ☐ experienced in teaching agriculture but wanting to try a different approach

☐ Distance Learning Teacher

- ☐ travelling to schools within the jurisdiction
- ☐ using facsimile and teleconferencing to teach students within the area

☐ Larger Schools Teacher

- ☐ inexperienced
- ☐ experienced in teaching agriculture but wanting to try a different approach



Because these materials have been created by experienced classroom teachers and distance learning specialists, they have many advantages for students and teachers regardless of their situations.

Advantages for Students

- incorporates a strong learner-centred philosophy
- promotes such qualities in the learner as autonomy, independence, and flexibility
- is developed through media which suit the needs and circumstances of the learner
- reflects the experiential background of Alberta students
- opens up opportunities by overcoming barriers that result from geographical location
- promotes individualized learning, allowing learners to work at their own pace

Advantages for Teachers

- allows teachers maximum teaching time and minimizes preparation time
- includes different routes through the materials to suit different learners
- incorporates a wide range of teaching strategies, in particular those using independent and individual learning
- delivers curriculum designed by education specialists that reflects the Alberta Education Program of Studies with an emphasis on Canadian content
- provides learning materials which are upwardly compatible with advanced educational technology

Does it sound like something you could use?

The student materials are not the only components designed for independent, guided instruction; so is this Learning Facilitator's Manual. It begins with an overview of the current Alberta Education Program of Studies for Agriculture: Land and Life. This summary is included for inexperienced teachers or those teachers who have found themselves teaching agriculture when their training is in other subject areas. This brief summary is not meant to replace the Alberta Education Program of Studies, but rather to help teachers confirm the highlights of the program.

Other parts of this introduction have also been included to help teachers become familiar with this new courseware and determine how they might want to use it in their classroom.

Beyond the introduction the guide itself contains answers, models, explanations, and other tips generated by the teachers who authored this course.

The courseware and LFM are the products of experienced classroom teachers and distance learning specialists. It is the hope of these teachers that their experience can be shared with those who want to take advantage of it.



Overview of the Program of Studies

The Agriculture: Land and Life program for junior high school students provides a three-year sequence of complementary courses. The objective of the program is to provide a broad awareness of the economic, social, and scientific realities of the agricultural enterprise. Learning is introduced in meaningful contexts through hands-on activities and print or media pathways. Through a variety of pathways, students can pursue their personal interests while broadening their understanding of the world in which they live.

The course has been designed to be of interest to both urban and rural students with a balance of perspectives including those of consumers, home gardeners, and workers in food production and processing.

The emphasis of the program is on awareness and insight rather than on specific skills.

Goals of the Agriculture: Land and Life Program

- to develop an awareness of the diversity of agricultural activity in students' local areas, in Alberta, and in the national and international communities
- to develop critical-thinking and problem-solving skills in the process of examining agricultural problems and practices
- to acquire knowledge about agricultural production and processing
- to recognize relationships between producers, processors, marketers, and consumers
- to appreciate agriculture for its economic significance, career opportunities, and for its impact on the quality of life
- to acquire knowledge and develop skills applicable to plant and animal care in both urban and rural settings
- to develop a resource management perspective, recognizing areas where personal and public decision making are needed
- to acquire an awareness of agricultural technologies, including an examination of emerging technologies as well as those of the past and present
- to develop an awareness of societal issues and concerns that are related to agriculture
- to develop an awareness of agriculture's scope in urban areas

Program Organization

The program content is organized into themes which are repeated over the three-year sequence. These themes are developed in a series of modules for each year of the program. Students may enter the program at any year and complete the modules in any order. A suggested minimum time commitment for each module is included in the following table.

Theme	Year One	Year Two	Year Three
Production, Processing, and Marketing	Module 1 Milk and Milk Products 20 hours	Module 3 Meat and Meat Products 20 hours	Module 1 Field Crops and Energy 20 hours
Technology and Research	Module 2 People, Machines and Grain 20 hours	Module 2 Greenhouse Technology 20 hours	Module 2 Biotechnology 20 hours
Resource Management	Module 3 Managing Water Resources 20 hours	Module 1 Managing Soil Resources 20 hours	Module 3 Managing the Land 20 hours
	Module 4 What Is Agriculture? 15 hours	Module 4 Part A: What Is Agriculture? or Part B: Project 1/Project 2 15 hours	Module 4 Student Projects 15 hours

Overview of Agriculture: Land and Life Year Two

The modules included in the Agriculture: Land and Life Year Two program are summarized as follows:

Module 1: Managing Soil Resources

Soil is a basic resource for food production. The quality of the soil can determine the success of a farm. The degradation of soil quality is a major concern. This module examines the important characteristics of soil and considers some of the problems of soil management.

Module 2: Greenhouse Technology

Growing plants can be thought of as a series of planned interventions that will enhance the growth of a food crop. Students will learn about these interventions, and explore some of their implications, through a series of practical activities. Because many of the activities in this module must be monitored over time, it is recommended that students complete them while working on Module 1 or Module 3.

Module 3: Meat and Meat Products

This module is a case study of meat as a nutritious food. Alternate foods with similar nutrient values are also discussed. This unit will also explore how meat is produced, processed, and packaged to satisfy the needs and preferences of consumers. Because many of the activities in this module must be monitored over time, it is recommended that students complete them while working on Module 1 or Module 2.

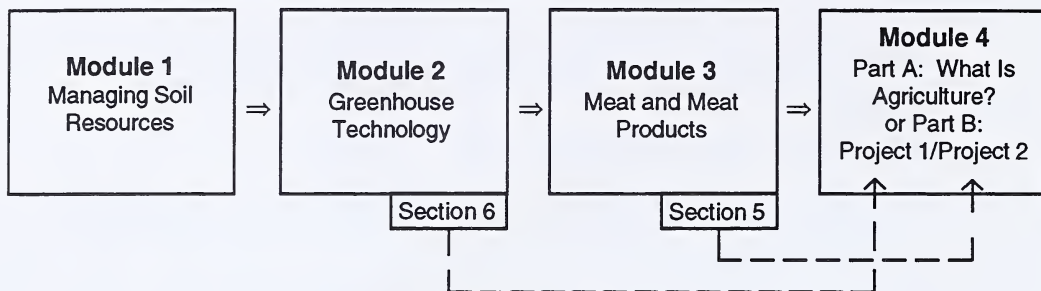
Module 4: Part A – What Is Agriculture? Part B – Project 1/Project 2

Part A is a comprehensive review of agricultural activity to provide students with a sense of its diversity and scope. The perspective adopted in Part A is that agriculture involves more than just the farm, and that the impact of agriculture can be seen in all of society. Part A examines agriculture at a variety of levels from local to global and introduces students to Alberta's role as both an importer and an exporter of agricultural commodities.

Part B consists of two projects – a plant project and an animal project. Since the plant and animal projects need to be done over a period of time, the instructions for doing the plant project are located in Section 6 of Module 2, and the instructions for the animal project are located in Section 5 of Module 3. However, the assignments for both projects are located in the Module 4 Assignment Booklet: Part B. This allows students time to pursue the project work while completing the rest of the material in the course.

Note: Students who previously completed the Agriculture: Land and Life Year One program, and are now taking the Year Two program, must do Part B of Module 4.

Students who entered the Agriculture: Land and Life program at the Year Two level, must do Part A of Module 4.

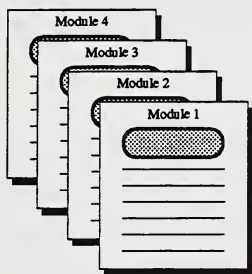


Structure of the Learning Package

Basic Design

This new learning package involves many other components in addition to the Learning Facilitator's Manual.

Modules



The print components involve many booklets called modules. These modules contain guided activities that instruct students in a relevant, realistic setting.

The modules have been specially designed to promote such qualities in the learner as autonomy, independence, and flexibility. Writers have incorporated such teaching strategies as working from the concrete to the abstract, linking the old to the new, getting students actively involved, and using advance, intermediate, and post organizers. Many other techniques enable learners to learn on their own for at least some of the time.

The structure of the module booklets follows a systematic design. Each module begins with a detailed table of contents which shows the students all the main steps. It acts as an organizer for students. The overview introduces the module topic or theme. A graphic representation has been included to help visual learners and poor readers. The introduction also states the weightings of each assignment.

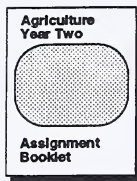
The body of the module is made up of two or more closely related sections. Each section contains student activities that develop skills and knowledge centred around a theme.

The activities may involve print, audio, and video formats. At times the student and the learning facilitator are allowed to choose the activity that best suits the student's needs and interests. Other activities such as the Extra Help and Enrichment are optional pathways. This flexibility caters to each student's personal situation.

The summary focuses on the skills and strategies that the student has learned.

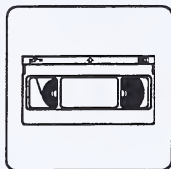
Contents
Overview Evaluation
Section 1 Activity 1 Activity 2 etc.
Section 2 Activity 1 Activity 2 etc.
Section 3 Activity 1 Activity 2 etc.
Section 4 Activity 1 Activity 2 etc.
Module Summary

Assignment Booklet



Accompanying each module is an assignment booklet. The activities in these booklets can be used for formative and for summative assessments. The students should complete these assignment booklets when they have thoroughly reviewed the module materials. The assignment booklets have been designed for classroom use, for faxing, or for mailing. **If the booklets are not being mailed, you should remove the outside cover.**

Media



VIDEOCASSETTE

The package also includes references to media. Pathways have been developed so students can use a variety of media to achieve the objective. These different routes have been included to suit different learners. Wherever videos have been included, a print pathway is also available. This way, if the media resource isn't available or desired, a student can follow the print pathway and still successfully achieve the objective.

Textbook



Module 1 – Managing Soil Resources has been designed to include references to the textbook, *The Living Soil: A Renewable Resource*.

Materials, Media, and Equipment

Mandatory Components

Equipment (Hardware)	Media	Materials
		• LFM for Agriculture: Land and Life Year Two • one complete set of module booklets (4) and assignment booklets (4) for each student • There is no final test.

Optional Components

Equipment (Hardware)	Media	Materials
• VCR • Video camera • Audiocassette player/recorder	• videocassettes (Videocassettes used in the course may be available from the ACCESS Network or your regional media centre.) • Some activities and assignments may be submitted using a videotape format. • Some activities and assignments may be submitted using audiocassettes.	• Some modules or projects require materials that can only be acquired at certain times of the year. If so, these materials will be listed in the Student Module Booklets as part of Preparation (see Contents). As an alternative you may wish to adjust the order in which modules are completed so that materials can be easily obtained. • Some activities and assignments will require materials such as soil samples, flower pots, plant seeds, animals, or animal feeds. In most cases students will have an alternative print pathway not requiring these materials. However, to get the maximum benefit and satisfaction from the course, the hands-on activities are recommended.

Using This Learning Package in the Classroom

Conventional Classroom

Whether your classroom has desks in rows or tables in small groups, you may be most comfortable with a learning system that you can use with all your students in a paced style. In other words, you may want a package that will suit all of your students, so they can move through the materials as one group or several small groups. Because these materials contain different routes or pathways within each unit, they can address various learning styles and preferences. The materials also include many choices within the activities to cater to different thinking levels and ability levels. Because of their versatility and flexibility, these materials can easily suit a conventional classroom.

Open-Learning Classroom

Open learning is the concept of opening up opportunities by overcoming barriers of time, pace, and place by giving the learners a package specially designed to enable them to learn on their own for at least some of the time.

Such a concept is not new. Many teachers can recite attempts to establish an individualized learning system as they recognized the importance of trying to personalize courseware to meet each individual student's needs. But these efforts often failed due to a lack of time and quality materials that conformed to Alberta specifications.

Due to advanced educational technology and improved Alberta-specific learning packages, a student-centred approach is now possible. Improved technology now allows us to provide support to learners individually, regardless of their pace or location. A teacher cannot be in twenty-eight places at one time offering guidance. However, media and a well-designed learning package can satisfy individual needs. Technology can also help provide an effective management system needed to track the students as they progress independently through the materials.

The key to a successful open-learning system depends on three vital elements: a learning package specially designed to enable students to learn effectively on their own for at least some of the time; various kinds of learner support; and a management system and style that ensures that the open-learning system runs smoothly.

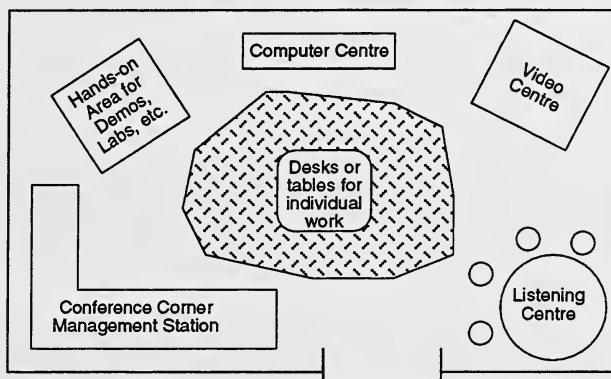
The Key to a Successful Open-Learning System



Learning Package

The specially designed learning package needed for a successful open-learning system has been developed for you. The objectives teach current Alberta specifications using strategies designed for individualized instruction. As the learning facilitator, you need to be sure to have all the components in the learning package available to students as needed.

If adequate numbers of media are available to satisfy the demand, a centre can be established for specific media.



You may not have the luxury of having enough hardware to set up a permanent video or computer centre in your classroom. In that case, students should be encouraged to plan ahead. Perhaps every three to five days they should preview their materials and project when they would need a certain piece of media. This would allow you to group students, if necessary, or reserve media as required.

Support

Support is definitely a key element for successful learning, and when you're planning an individualized, non-paced program, you need to carefully plan when and how support will be given.

The answers, explanations, and examples for each of the module activities are included in this LFM. You may decide to set up an answer station with colour-coded cards, or you may want the students to come to you to discuss the activity together. As you and the student become more comfortable with an individualized system, you might increase the student's responsibilities – spot checking only to reinforce proper behaviour and to assess the student's day-to-day progress.

As the learning facilitator, you may be needed to offer more personal guidance to those students having difficulty, or you may need to reinforce the need for students to do these activities carefully before attempting the assignments in the assignment booklet.

The activities include choices and pathways. If a student is having difficulty, you may need to encourage that student to work on all the choices rather than one. This would provide additional instruction and practice in a variety of ways.

Another form of support is routine contact with each individual. This might be achieved with a biweekly conference scheduled by you, or as students reach a certain point (e.g., after each section is completed), they may be directed to come to the conference area.

Special counselling may be needed to help students through difficult stages. Praise and encouragement are important motivators, particularly for those students who are not used to working independently.

Direct teaching may be needed and scheduled at certain points in the program. This might involve small groups or a large group. It might be used to take advantage of something timely (e.g., an election or eclipse), something prescheduled like the demonstration of a process, or something involving students in a hands-on, practical experience.

Support at a distance might include tutoring by phone, teleconferencing, faxing, or planned visits. These contacts are the lifeline between learners and distance education teachers, so a warm dialogue is essential.

Management

Good management of an open-learning system is essential to the success of the program. The following areas need action to ensure that the system runs smoothly:

- **Scheduling, Distributing, and Managing Resources** – As discussed earlier, this may require a need for centres or a system for students to project and reserve the necessary resources.
- **Scheduling Students** – Students and teachers should work together to establish goals, course completion timelines, and daily timelines. Although students may push to continue for long periods of time (e.g., all morning), teachers should discourage this. Concentration, retention, and motivation are improved by taking scheduled breaks.
- **Monitoring Student Progress** – You will need to record when modules are completed by each student. Your data might also include the projected date of completion if you are using a student contract approach.



Sample of a Student Progress Chart

Agriculture (Year Two)		Module 1	Module 2	Module 3	Module 4
<i>Billy Adams</i>	P				
	A				
<i>Louise Despins</i>	P				
	A				
<i>Violet Klassian</i>	P				
	A				
P = Projected Completion Date A = Actual Completion Date					

The student could keep a personal log as well. Such tracking of data could be stored easily on a computer.

- Recording Student Assessments – You will need to record the marks awarded to each student for work completed in each module assignment booklet. The marks from these assignment booklets will contribute to a portion of the student's final mark. Other criteria may also be added (a special project, effort, attitude, etc.). Whatever the criteria, they should be made clear to all students at the beginning of the course.

Sample of a Student Assessment Chart

Agriculture (Year Two)	Module 1 25%	Module 2 25%	Module 3 25%	Module 4 25%	Final Mark
<i>Billy Adams</i>	67	65	54	47	58
<i>Louise Despins</i>	43	50	54	55	51
<i>Violet Klassian</i>	65	55	66	68	64

Letter grading could easily be substituted.

- Recording Effectiveness of the System – Keep ongoing records of how the system is working. This will help you in future planning.

Sample of a System Assessment Chart

Module 1			
Date	Module Booklet	Assignment Booklet	Resources/Media

The Role of the Teacher in an Open-Learning Classroom

The teachers in a conventional classroom spend a lot of time talking to large groups of learners. The situation in open learning requires a different emphasis. Teachers will probably meet learners individually or in very small groups.

With this approach it is necessary to move beyond the idea of a passive learner depending largely on a continually supportive teacher. The teacher must aim to build the student's confidence, to stimulate the learner into self-reliance, and to guide the learner to take advantage of routes that are most meaningful and applicable to the learner.

These materials are student-centred, not teacher-centred. The teacher needs to facilitate learning by providing general support to the learner.

Evaluation

Evaluation is important to the development of every learner. Data gathering and processing, and decision making, at the student and teacher level, serve as means of identifying strengths and weaknesses.

These specially designed learning packages contain many kinds of informal and formal evaluation.

Observation

In the classroom the teacher has the opportunity to see each student perform every day and to become aware of the level and nature of each student's performance.

Observations are more useful if they are recorded in an organized system. The following list of questions is a sample of types of observations and how they can be collected.

Observation Checklist

1. Does the student approach the work in a positive manner?
2. Is the student struggling with the reading level?
3. Does the student make good use of time?
4. Does the student apply an appropriate study method?
5. Can the student use references effectively, etc.?

	B. Adams	L. Despina	V. Klassian	H. Smith	K. Dalley

Observation may suggest a need for an individual interview with a student.

Individual Conferences

Individual conferences may be paced (scheduled) by the calendar or at certain points in the module, or they may be set up only as needed or requested.

During these conferences teachers can determine the student's progress and can assess the student's attitudes toward the subject, the program, school, and self, as well as the student's relationship with other students. With guided questions the teacher can encourage oral self-assessment; the student can discuss personal strengths or weaknesses in regard to the particular section, module, or subject area.

Self-Appraisal

Self-appraisal helps students recognize their own strengths and weaknesses. Through activities that require self-assessment, students also gain immediate feedback and clarification at early stages in the learning process. Teachers need to promote a responsible attitude toward these self-assessment activities. Becoming effective self-assessors is a crucial part of becoming autonomous learners. By instructing, motivating, providing positive reinforcement, and systematically supervising, the learning facilitator will help students develop a positive attitude toward their own progress.

For variation, students may be paired, and peer assessing may become part of the system. The teacher may decide to have the student self-assess some of the activities, have a peer assess other activities, and become directly involved in assessing the remainder of the activities.

When the activities have been assessed, the student should be directed to make corrections. This should be made clear to students right from the start. It is important to note the correct association between the question and the response to clarify understanding, aid retention, and be of use for study purposes.

Many of the activities include choices for the student. If the student is having difficulty, more practice may be warranted, and the student may need to be encouraged to do more of the choices.

Each section within a module includes additional types of activities called Extra Help and Enrichment. Students are expected to be involved in the decision as to which pathway best suits their needs. They may decide to do both.

Self-appraisal techniques can also be introduced at the individual conferences. Such questions as the following might be included:

- What steps are you taking to improve your understanding of this topic?
- What method of study do you use most?
- How do you organize your material to remember it?
- What steps do you follow when doing an assignment in your assignment booklet?
- What could you do to become an even better reader?
- Do you have trouble following directions?
- Did you enjoy this module?

A chart or checklist could be used for recording responses.

Informal Evaluation: Assignments

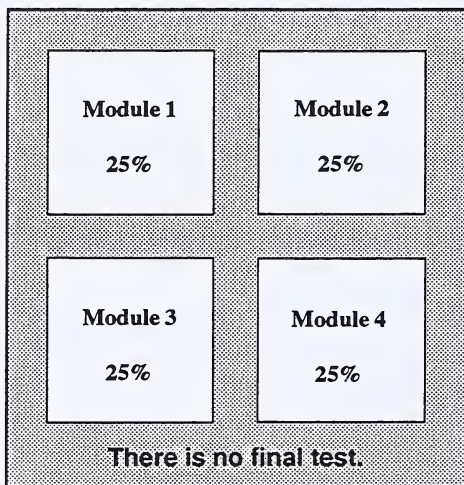
Informal evaluation, such as the assignments included in each module, are an invaluable aid to the teacher. They offer ongoing assessment information about the student's achievement and the behaviour and attitudes that affect that achievement.

Each module contains a separate booklet called the Assignment Booklet. This booklet assesses the knowledge or skills that the student has gained from the module. **The student's mark for the module may be based solely on the outcome of learning evident in the assignment booklet; however, you may decide to establish a value for other variables such as attitude or effort.** It is important that you establish at the beginning which outcomes will be evaluated, and that all students clearly understand what is expected.

Final Mark

There is no final test for Agriculture: Land and Life Year Two.

The final mark may be determined by averaging the marks of the four modules. The value of each module is the decision of the classroom teacher. The following is a suggestion only.



Introducing Students to the System

Your initiation to these learning materials began with a basic survey of what was included and how the components varied. This same process should be used with the class. After the materials have been explored, a discussion might include the advantages and the disadvantages of learning independently or in small groups. The roles of the students and teacher should be analysed. The necessary progress checks and rules need to be addressed. Your introduction should motivate students and build a responsible attitude toward learning autonomously.

Skill Level

It is important for students to understand that there are certain skills that they will need in order to deal successfully with the course materials. They include the following:

- understanding and using instructional materials (table of contents, index, list of illustrations, appendices, bibliography, and glossary)
- interpreting maps, graphs, and charts
- using reference materials
- recognizing special symbols
- learning interviewing techniques

Other general skills are using reliable study methods, outlining, and learning to read at a flexible rate.

To decide the level and amount of instruction needed to accommodate the varied levels among students, you may wish to prepare and administer skill inventories or pretests. If most students need help with a particular skill, you may want to plan a total class instructional session. If only certain students lack a skill, you may want to set up a temporary skill group to help students who need it, or you may want to develop a skills file for this purpose.

Reading Level

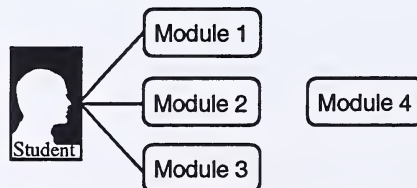
These course materials are largely print based, but poorer readers need not be discouraged. It is important that you assure the students that these materials have been designed for easy reading. The authors have employed special strategies that lower and control the reading level. Some of them are

- the conscious selection of vocabulary and careful structuring of sentences to keep the materials at an independent reading level
- the integration of activities, examples, and illustrations to break text into appropriate-sized chunks
- the inclusion of many kinds of organizers (advance, graphic, intermediate, concept mapping, post organizers) to help give students a structure for incorporating new concepts

- the recognition that vocabulary and concepts are basic to understanding content materials and, thus, must be handled systematically (defined in context, and often in a specialized glossary in the Appendix)
- the acknowledgement that background knowledge and experience play a vital role in comprehension
- the systematic inclusion of illustrations and optional videos to help poorer readers and visual learners, as an alternative to print-based learning
- a variety of formats (paragraphs, lists, charts, etc.) to help poorer readers who do not absorb or retain main ideas easily in paragraph format
- the inclusion of media pathways and activity choices to encourage an active rather than a passive approach
- instruction in a meaningful setting rather than in a contrived, workbook style
- using purposeful reading, viewing, and doing to produce a better interpretation of the course materials
- the recognition that students need structured experiences when reading, viewing, or listening to instructional materials: developing pupil readiness, determining the purpose, providing guided instruction and feedback, rereading if necessary, and extending. (This structure closely resembles the reading process.)

To help make the learning package more readable, you can begin in your module preparation by reading (previewing) all the related materials that are going to be used. You need a solid background in order to assess and develop a background knowledge for students. The students' experiential bases may be assessed through brainstorming sessions concerning the topic, having students write down all the ideas they have about the topic, or by using visuals and guided questions to predict what the topic might be about.

Modules 1, 2, and 3 are self-contained. Students may work on any of these modules in any order. However, in terms of Module 4, students doing Part A of Module 4 should do Module 4 last, while students doing Part B of Module 4 should work on Module 4 in conjunction with Modules 2 and 3.



As the learning facilitator you have a key role in determining the success your students have in taking this course. Students need encouragement and the confidence of knowing that the course is important to their futures. At times, they also need help to clear up misunderstandings or to confirm that what they are doing is correct.

After the introductory pages of each module there are answers, models, explanations, and other tips generated by teachers who authored this course. So that the learning facilitator does not have to keep referring to the Student Module Booklet, the questions are reprinted from the Student Module Booklet, and the suggested answers are printed in italics. However, for more detailed instructions to the activities, the learning facilitator will need to refer to the information in the Student Module Booklet. Comments where applicable are made, and enclosed by a box, to guide the learning facilitator.

Correct and discuss the answers with the student as the student completes each activity. In this way the student receives immediate feedback to clarify and reinforce his or her basic understanding before he or she moves on to the next activity.

The main concepts that students are to learn in each section are stated at the beginning of each section in the Learning Facilitator's Manual. If the learning facilitator wishes to have a more complete guide as to the attitudes, skills, and other learner expectations which students are to achieve, he or she will need to refer to the Junior High School Program of Studies.

Towards the end of each section there are Follow-up Activities. Here the activities are separated into two strands: Extra Help and Enrichment. If students had some difficulties understanding the concepts and the activities, it is recommended that they do the Extra Help. If students had a clear understanding of the concepts and had few difficulties completing the activities, it is recommended that they do the Enrichment. As the learning facilitator, you should assist students in choosing the appropriate path.

The Learning Facilitator's Manual also includes the answers to the assignments in the assignment booklets. Remember that the answers to the assignments should be kept secure by the teacher. Students should not have access to the assignment booklet answers. These answers should be stored securely and retained by the teacher at all times.

Although the value assigned to each question in the assignment booklet is the decision of the classroom teacher, suggested values are given in brackets at the end of each question.



AGRICULTURE: LAND AND LIFE

Year Two / Module 1

Managing Soil Resources

Learning Facilitator's Manual



**Distance
Learning**

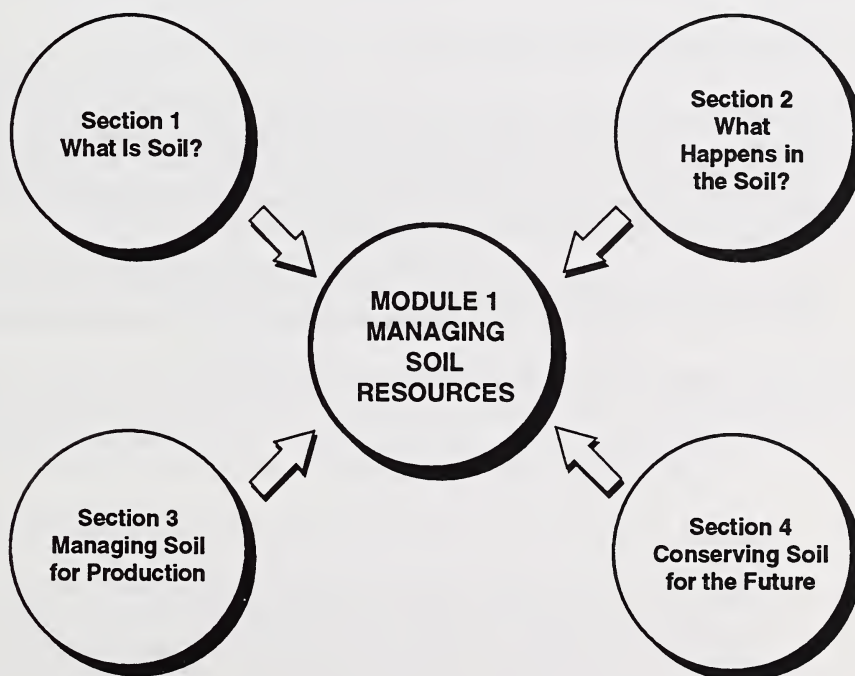
Alberta
EDUCATION

Module 1: Managing Soil Resources – Overview

Soil is a basic agricultural resource. Good quality soil can produce a bountiful harvest and contribute to a successful farming operation. Poor soil produces stunted crops and results in abandoned farms. This module examines some of the methods used to manage the soil for food production.

In this module students will

- examine the characteristics that determine the overall quality of soil
- see the living things in soil that make it work
- learn some of the ways in which soil is managed to produce better crops
- discover the problems facing the soil resource, and determine how these problems can be controlled



Evaluation

The student's successful completion of all assignments in the Assignment Booklet will depend on practice obtained while doing the various activities in the Student Module Booklet. In this module students are expected to complete four section assignments.

The following distribution of marks is suggested in determining the student's grading for this module.

Section 1 Assignment	25%
Section 2 Assignment	25%
Section 3 Assignment	25%
Section 4 Assignment	<u>25%</u>

TOTAL 100%

Although the value of each module for the Agriculture: Land and Life Year Two course is the decision of the classroom teacher, it is suggested that Module 1 be worth 25% of the total final grade, based on an equal weighting of the four modules in this course.

Materials Needed for Module 1

In order to assist students effectively in their study of this course, it may be helpful to preview Module 1. This will give you an idea as to how the topics are developed; it will also give you an overview of the materials needed in the module. In some cases if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

Most of the materials needed for Module 1 can be obtained when students are ready to do an activity. However, some materials should be collected ahead of time so they are available as needed.

1. The following textbook is required to complete Module 1:

- *The Living Soil: A Renewable Resource – A Science Module*, by Sue Bland and Marilyn Lewry. Weigl Educational Publishers Limited, Edmonton and Regina, 1991.

This textbook is available for purchase from the Learning Resources Distributing Centre (LRDC).

2. Students will need to collect a sample of topsoil (the darkest layer near the surface) to experiment with in several activities. The topsoil should be obtained as soon as possible, so that it is available when it is needed. If it is winter and students are unable to gather a sample outside, then you may be able to obtain surplus samples from a soils laboratory at the provincial Agricultural Soils and Animal Nutrition Laboratory, Edmonton, or from another available local source, such as an agricultural office.

3. Students will require materials for testing soil acidity. You may need to assist them in getting these materials. Students may
- use litmus paper which can be obtained from a school science laboratory or a local pharmacy
 - use specially treated strips of paper contained in soil test kits available from gardening stores
 - use a pH meter, if one is available

Media

To obtain the videotape resources for this module, contact either your regional media centre or the ACCESS Network.

The following five video programs are suggested if students use the optional media pathways in Module 1:

- *Vegetation and the Soil*, Part 4 from the series *North America: Growth of a Continent*, VHS videotape, 15 min.
- *Soil: Understanding Our Earth*, VHS videotape, 12 min.
- *A Sense of Humus*, VHS videotape, 28 min.
- *Oh! Gully! Where is the Soil?*, VHS videotape, 22 min.
- *Gone With the Wind – Too!*, VHS videotape, 24 min.

Note: If the media resources are not available, students will still be able to complete the activities by following the module booklet or the textbook, *The Living Soil: A Renewable Resource*.

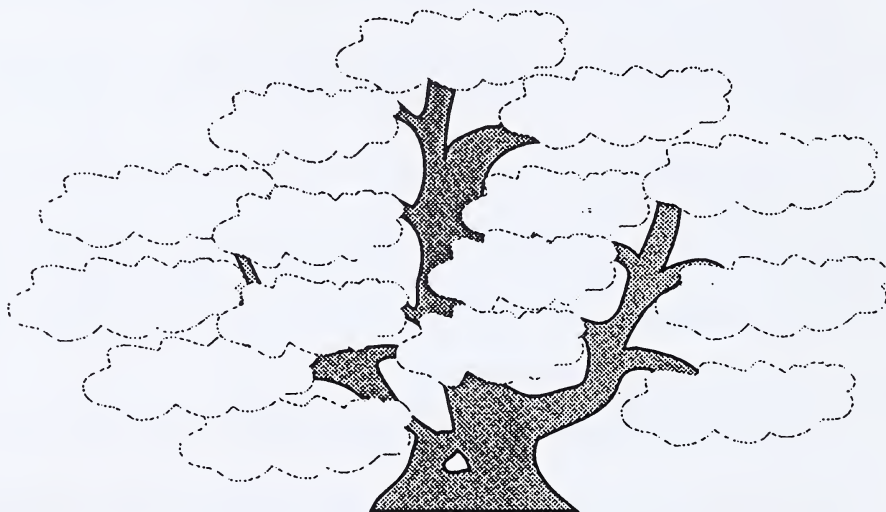
Section 1: What Is Soil?

In this section students will learn about the importance of soil for their survival and comfort. They will examine a sample of soil and find out how it is formed in nature, and how the properties help to classify soil and determine its use for agriculture.

Check and discuss the answers to the following activities with your students.

Section 1: Activity 1

1.



Use this tree to discover the importance of soil to the food, materials, and activities that you enjoy each day.

- On the lowest branches, write the names of plants that are grown in soil.
- On the next branch above, write the names of products or animals that depend on these plants.
- On the next branches, write the names of products, animals, or activities that depend on the branches below.
- Continue this process until all of the branches are filled with names.

The answers will be written on the tree branches in the Student Module Booklet. Answers will vary. This question works well as a brainstorming activity with a group of students.

2. What does a plant obtain from soil that it cannot get from water or the air?

Soil provides nutrients for plant growth. Without an external supply of nutrients, normal growth would be incomplete and the hydroponic plant would eventually collapse and die.

3. Could all of the world's food needs be satisfied with plants that are grown hydroponically? Explain.

People can grow plants very efficiently with hydroponics, but this is a method that depends on expensive labour and limited natural resources. It would be impossible to produce enough food to satisfy everyone's needs using this method. Then there are all of the other living things that depend on plants grown in soil – it would not be possible to produce food for all of these by hydroponics.

Students can observe the growth of a plant without soil by starting with two small plants of similar size from a gardening shop. One plant should be carefully removed from the pot and the soil carefully cleaned from the roots. This plant should then be placed in a glass of water as shown in the Student Module Booklet. A cardboard collar can be cut from a milk carton to keep the top growth above the surface of the water, and a screen of black paper can be placed around the glass to keep the roots from the light. The growth of this plant can be compared with the growth of the second plant (which is grown normally in soil) as the students work on this module.

4. How could a knowledge of soil be important to you in the future? Be creative!

Answers will vary. Students may give acceptable answers that go beyond the standard answers of soil being important for

- *growing plants which supply food and oxygen for humans and other life forms*
- *landscaping*
- *gardening*

Section 1: Activity 2

This activity will require students to obtain a sample of topsoil. You may wish to collect this sample as a class outing. Be sure to point out other aspects of the soil when you are there, such as the importance of roots, and a vegetation layer at the surface. Show the students a soil profile and identify the topsoil layer.

If you are unable to obtain a good soil sample, you may check at a local soils lab or local agricultural office to see if they have surplus samples. These soil samples are usually available with a complete soil analysis, which could serve as a handy answer key for some parts of this activity.

1. Describe where you obtained your soil sample.
2. Describe your soil as follows:
 - a. Colour:
 - b. Smell:
 - c. Feel:
3. Do you see living things in your sample?
4. Can you identify any remains of dead plants or animals?
5. Separate the components of your soil sample as follows (*using the method described in a. to d. in the Student Module Booklet*):
 - e. If possible, compare your soil sample with examples collected by other agriculture students. What differences can you see?

Answers to questions 1 to 5 will vary. Different soil samples will vary in colour, odour, texture, and organic content.

Students should save their soil samples for a later activity in which they will determine several important soil characteristics.

Section 1: Activity 3

Students can obtain the answers to the questions in this activity in one of three ways:

- by watching media resources about soil formation
- by reading the assigned pages in the textbook
- by reading the summary in the Module Booklet

The following videotapes are about soil formation:

- *Soil: Understanding Our Earth*
- *Vegetation and the Soil, Part 4* from the series *North America: Growth of a Continent*

1. Which of the weathering processes mentioned in the diagram are physical processes? Circle and label them with a coloured pencil.

The following are physical processes:

- *water is repeatedly frozen and thawed*
- *running water*
- *windswept sand*

2. Which of the processes are chemical or biological? Circle and label them with a second colour.

The following processes are chemical or biological:

- *It (a lichen) recovers nutrients from the rock by attacking its surface with weak acids.*
- *Water will dissolve soluble minerals and leave other minerals behind.*
- *Air and water take part in chemical reactions that break down minerals in rocks.*
- *The roots of a tree can enter small cracks and open the cracks to split rocks apart.*

Students can try the method described in “Activity 2: How Do You Weather a Rock?” on page 11 of *The Living Soil: A Renewable Resource*, or use the method described in question 3 to answer questions 3. a. to 3. d.

3. Gather several rocks and try to “weather” them using the following methods.

- a. Rub two rocks together. Did you have any success?

Breaking down rocks by abrasion is a slow and difficult process.

- b. Test for hardness by scratching each rock sample with a nail. Put your samples in order from hardest to lightest.

A nail has a hardness of about 5 on Moh’s hardness scale (1 to 10). Igneous rocks and quartzite sandstones will be harder (> 5), while carbonate rocks or shales will generally be softer (< 5).

- c. Obtain a small sample of weak five percent HCl from your science teacher. Use an eyedropper to place a few drops of acid on each sample. Fizzing and bubbling will indicate the presence of calcium carbonate, which is a mineral easily dissolved by acid solutions. How will this affect the rock?

Weak acids will dissolve calcium carbonate in limestones and other carbonate rocks, or rocks with a carbonate cement. Once part of a rock or the cementing material holding the particles together is dissolved, the remainder of the rock will be more easily eroded.

- d. Do you want proof of the power of expanding water? If so, fill a small glass jar to the top with water. Place the lid on tightly. Put the jar inside a strong plastic bag and freeze it overnight. What happened to the jar? Why did this occur?

The jar will break. This experiment provides visible proof that water expands when it is frozen.

4. Give examples of the types of organic matter that you might find in the soil.

Organic matter found in the soil may include parts of living plants (plant roots, leaves, and seeds), animals (earthworms), microorganisms (bacteria and fungi), remains of dead plants and animals, plus decomposed plants and animals (humus).

5. How is organic matter important to soil?

Organic matter

- *acts as a reservoir of nutrients that can be recycled and used by plants*
- *provides a “glue” to bind particles of soil together and prevent erosion*
- *improves the ability of soil to hold moisture*

6. Imagine that you are a soil scientist. By now you will have determined how soils form, and know something about the past climate in Alberta. Number the following sequence of events in chronological order to describe how soil has formed in this province.

- 8 The rich prairie topsoil supports grasslands and agriculture.
- 2 The climate gradually warms until the last great glacier melts about 10 000 years ago.
- 6 Tiny microorganisms in the soil decompose organic matter to release nutrients and enrich the soil.
- 3 or 4 Water enters cracks in the rocks and expands as it freezes. A repetition of this process over many years causes the rocks to break into smaller and smaller pieces.
- 5 The climate continues to warm up. Grasses and trees replace Arctic vegetation.
- 1 Great continental glaciers scour the northern parts of North America. Rocks and mineral matter become mixed into the ice as the glaciers move forward.
- 3 or 4 Hardy vegetation, such as lichens and mosses, grow in a climate much like the present-day Arctic climate. Acids produced by this vegetation etch the surface of the rocks.
- 7 Much of the vegetation cover dies every season. The remains of plants and animals accumulate in the soil.

7. The terms topsoil, subsoil, and parent material describe the three main soil horizons. In your text, these zones have been identified as A-horizon, B-horizon, and C-horizon. Add these letters to the soil profile, beside the zones where they apply.

Topsoil – A-horizon

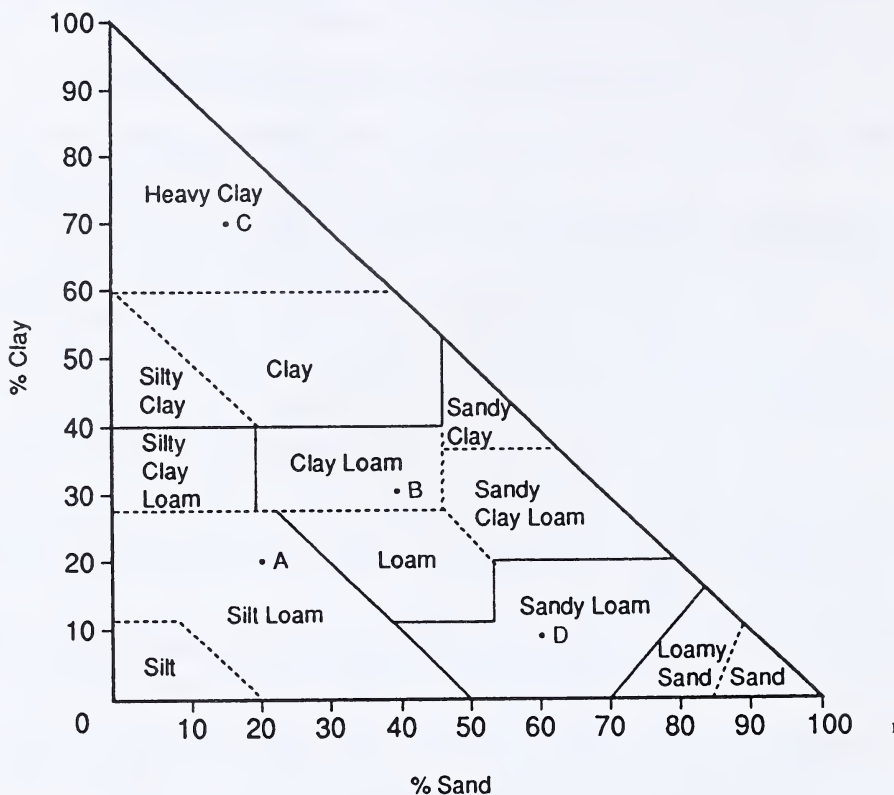
Subsoil – B-horizon

Parent Material – C-horizon

8. The root zone is the normal depth from which roots recover water and nutrients. Which soil horizons does this zone usually represent?

The root zone usually represents the A- and B-horizons.

Section 1: Activity 4



1. Use the soil texture triangle to help you fill in the blanks in the following table. Plot these samples on the chart. Sample A has been done for you as an example.

Sample	Sand	Silt	Clay	Texture
A	20	60	20	silty loam
B	40	30	30	clay loam
C	15	15	70	heavy clay
D	60	30	10	sandy loam

¹ Alberta Agriculture for the chart from *Alberta Soils Course*. Reprinted by permission of Home Studies Section, Education Branch, Alberta Agriculture

2. Describe the texture of your own soil sample by feel, using the method in the following chart. Find the starting point on the chart and follow the instructions carefully until the choices lead to a texture description for your soil.

- The texture description of my soil is _____.

Answers will vary. Use the method described in the Student Module Booklet to determine texture.

3. Describe the soil structures that are best for farming.

Granular soil structures are best for seed germination, root penetration, and drainage, while blocky or platy structures can slow both root penetration and the downward movement of water.

4. What type of farm operations may damage soil structure? In what way?

Heavy farm equipment may compact soil and produce platy structures. Too much tillage can pulverize soil aggregates.

5. Based on the previous graph, how does the amount of clay affect a soil's ability to hold water?

Clay increases a soil's ability to hold moisture.

6. Examine the organic matter bar graph. Describe how the amount of organic matter in soil affects its ability to hold moisture.

Soils with high organic matter content can hold more moisture than soils with less organic matter.

Section 1: Activity 5

The information that students obtain in answering the questions in this activity will be needed in order for them to answer question 4 of Section 1 in the Module 1 Assignment Booklet. As the learning facilitator, you should be available to help the students obtain the necessary materials, to help with the various procedures described in this activity, and to provide feedback for their responses. By carrying out the various procedures in this activity, students should become familiar with some of the tests that are available in determining the characteristics most often used to describe soil.

1. Write down the colour of your soil, and estimate the amount of organic matter that it contains.

Answers will vary but should be within the limits described in the chart preceding this question in the Student Module Booklet. If an alternate explanation is offered, check to see that it is appropriate.

Have students omit the Extension Activity mentioned on page 33 of the Student Module Booklet, as the part on measuring the exact percentage of organic matter is not included as part of “Activity 3: How Can Soils Be Compared?” on pages 16 and 17 of *The Living Soil: A Renewable Resource* in the current edition of this textbook.

2. What is the textural description of your soil sample? If you are using a different soil sample than in the previous activity, determine the textural description of your new sample by feel, using the method described in the previous activity.

Texture name: _____.

Answers will vary, according to the proportions of sand, silt, and clay particles the students' soil samples contain. Check to see that the students arrived at their answers by using the method described in Activity 4 under “Determining Soil Texture by Feel.”

3. Use this texture description, and the soil texture triangle, to estimate the proportion of sand, silt, and clay in your sample.

Sand _____ (%)

Silt _____ (%)

Clay _____ (%)

Answers will vary. Check percentages with the texture triangle in Activity 4.

4. • volume of soil that fills the pot _____
- total volume of water added to the bowl _____
- volume of water that remained in the first bowl _____
- volume of water that drained from the flower pot _____

Answers will vary. The results stated here will be used to determine the answers to questions 5 to 8.

5. The porosity of a soil is the total amount of water absorbed by the soil in the flower pot. To calculate this you need to subtract the volume of water that remains in the bowl after the flower pot was removed from the bowl, from the total volume of water that was added to the bowl. Calculate how much water was lost from the first bowl when the flower pot was removed. (This gives you the total amount of water that was absorbed by the soil in the flower pot.)

Answers will vary. Check to see that the student used the values from question 4 (total volume of water added to the bowl minus the volume of water that remained in the first bowl) to arrive at an answer.

6. The porosity of a soil is usually expressed as a percentage. To determine the porosity of your soil sample as a percentage, you need to divide the amount of water absorbed by the soil in the flower pot by the volume of soil that was used to fill the flower pot, then multiply the result by 100. Calculate the porosity of your soil sample as a percentage.

Porosity =

Answers should be in the area of 25%. If the answer varies greatly from this percentage, check to see that the student followed the correct procedure to arrive at the results to question 4.

7. Field capacity is the amount of water remaining in the soil after excess water has drained away. To determine the field capacity of your soil sample subtract the amount of water that drained into the second bowl from the total amount of water absorbed by the soil in the flower pot. Calculate how much water remained in your soil sample after the excess water has drained away.

Answers will vary. Check to see that the student subtracted the volume of water that drained from the flower pot (part of question 4) from the answer that was obtained for question 5 in order to arrive at the answer for this question.

8. Field capacity is usually expressed as a percentage. To determine the field capacity of your soil sample as a percentage, you need to divide the amount of water that remained in your soil sample by the volume of soil that was used to fill the flower pot, then multiply the result by 100. Calculate the field capacity of your soil sample as a percentage.

Field capacity =

Answers should be 5 to 10% below porosity.

9. Why is field capacity an important soil characteristic?

Field capacity indicates how much water is available for plants, and tells how well the soil drains.

Students will require materials for testing the pH of their soil sample in order to answer question 10 and the Extension Activity, if they choose to do so. To test the pH of their soil sample, students may

- use litmus paper which can be obtained from a school science lab or a local pharmacy
- use specially treated strips of paper contained in soil test kits available from gardening stores
- use a pH meter, if one is available

10. Find the pH of your soil sample. Describe how you conducted the test.

Answers will vary. The range of soil pH for agricultural soils in Alberta is usually between 5.0 and 8.5. If the student answer seems unreasonable, you might suggest that the student repeat the pH test or use an alternate method of testing, if this is possible.

Extension Activity: Collect several different soil samples to complete the following chart. Make a solution with these samples and test for pH. Record the pH values that you obtain in the following chart.

Sample	Collected From	Colour	Texture	pH

Not all students will do the Extension Activity. For those who do, the comments made in the answer to question 10 will apply.

11. Describe how a knowledge of soil pH might be used to help you grow a better crop.

A knowledge of soil pH will help you select the right crop for the soil condition. You may also be able to determine if lime should be added to improve the pH of the soil.

When this activity is completed to their satisfaction, students may record the answers in their Assignment Booklet under question 4 of the Section 1 Assignment.

Section 1: Activity 6

1. Which soil order is most important for agriculture on the prairies?

Chernozemic soils are most important.

2. What is the main type of natural vegetation found in each of the areas just shown?

- *Foothills – aspen and evergreen forests, lodgepole pines*
- *Boreal Forest – coniferous (evergreen) trees, poplars*
- *Parkland – aspen trees, grasses, or crops*
- *Prairie – native grasses or cultivated grasses*

3. Which soil zones are best for cultivation (farming)? Why?

The black and dark brown soils are best for farming, because they are rich and fertile. They normally contain enough moisture to grow a wide variety of plants. Brown soils can also be used if the land is irrigated.

4. Which soil zone might be best for grazing livestock? Why?

Soil in the brown soil zone is fertile but lacks moisture. The grass cover protects it from erosion. This land is often used for grazing livestock.

5. Which zone is not suited for agriculture? Why?

Heavily forested areas are generally not suited for agriculture because they are usually very acidic, have low organic matter, and few nutrients in the topsoil. Parts of the brown soil zone are also unsuitable, due to a lack of moisture.

6. Which soil zone is the most abundant in Alberta?

Luvisolic soils or grey forested soils are the most common type of soil in Alberta. These soils lie under about 60% of the province's land area.

7. The distribution of soil zones and vegetation cover on the prairies is shown on two separate maps in your textbook, in the "Soils on the Prairies" section, starting on page 22.

- a. What soil is usually found under forested areas?

Luvisolic soils are usually found in grey forest soil zones.

- b. What soil zone is associated with parkland vegetation?

The black soil zone is related to parkland vegetation.

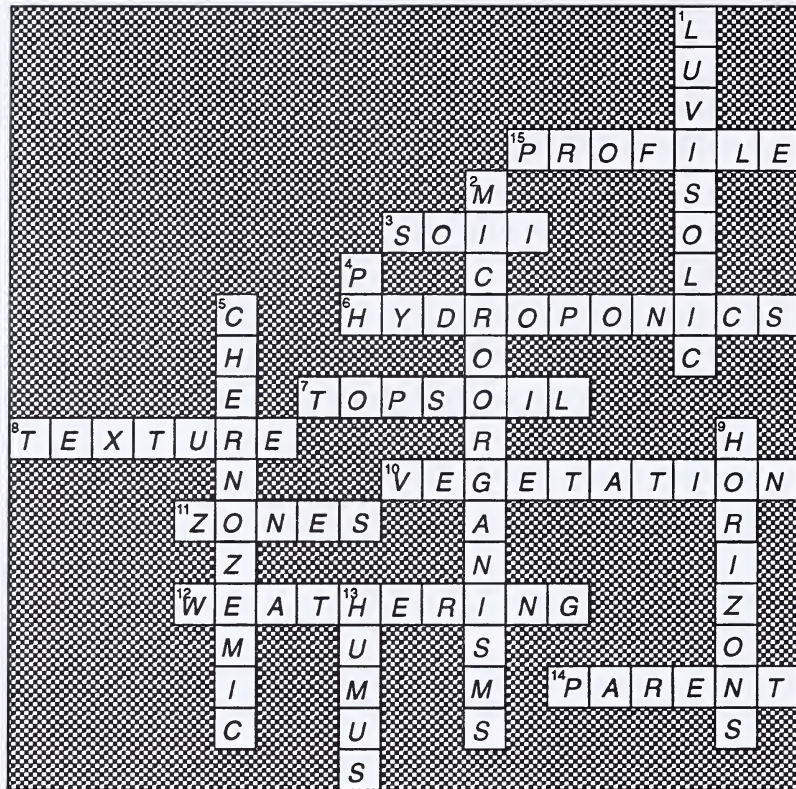
- c. What soil zone covers much of the southern prairies? What kinds of climate and vegetation created this type of soil?

The brown soil zone is found over much of the southern prairies. This type of soil is formed below hardy grasses that grow in very dry conditions.

Section 1: Follow-Up Activities

Extra Help

This section contains many new words that will be used throughout this module. Complete the following crossword puzzle to review the new vocabulary.



Down Clues

1. A soil order which forms below forested areas.
2. The living things that decompose organic matter in the soil.
4. This is a measure of acidity or alkalinity.
5. This is a soil order which forms below grass-covered areas.
9. These are the layers in the soil profile.
13. This is made from decomposed organic matter.

Across Clues

3. The materials covering the surface of the earth in which plants grow.
6. Growing plants without soil.
7. The organic layer of the soil profile.
8. This is used to describe soil based on the sizes of mineral particles.
10. This is necessary for the formation of soil.
11. The term applied to geographic areas that contain soils with similar soil profiles, and therefore similar conditions of formation.
12. The breakdown of rocks and minerals.
14. The material on which a soil forms.
15. The sequence of layers seen in soil.

Enrichment

Explain why most of the major cities in Alberta are located on the best farming land.

When the land was settled by Europeans, the best land was occupied first. These areas soon became development centres for the surrounding farmland, and towns developed. Continued growth swallowed up more and more land.

25

Section 1 Assignment

1. Write a definition of soil. (2)

Soil is the thin layer of material covering the surface of the earth in which plants grow.

2. Name the main components of soil. (4)

The main components of soil are minerals, organic matter, water, and air.

3. Write a story about a grain of sand and a blade of grass. Describe how they came together to make a home in the soil, despite their different backgrounds. Be sure to mention the five important soil-forming factors. (5)

Answers will vary but should include the following:

- *The type of **parent geologic material** determines many soil properties.*
- ***Climate and vegetation** are the most important factors influencing soil formation. Warmer climates and precipitation increase the amount of plant material that is added to the soil. Plants enrich the soil as they die and their remains decompose.*
- ***Time** influences the depth of weathering. Under ideal conditions it will take 200 years for 10 cm of soil to form.*
- ***Topography** modifies the effects of climate. Topography determines drainage, exposure to sunlight, and the ground temperature.*

4. In Section 1 you should have determined several characteristics of a soil sample from your own area. Your assignment is to complete a soil report using the results of your tests and other information about the sample. Record your answers to the questions on the form on the following response page. (14)

Answers will vary. If your students are using soil samples that have been analysed in a lab, you will have a basis to evaluate responses. In any case, look for consistent results and the correct application of methods described in the Student Module Booklet.

- a. Date soil sample taken:

Answers will vary.

- b. Location:

Answers will vary. The location may be given as a site description such as a woodlot, a field, along a fence line, beneath a grassed area or a wooded area, or as a geographic location such as Lethbridge or Peace River.

- c. Colour:

Answers will vary.

- d. Percent Humus:

Use the chart in the Soil Report to determine the percentage of humus, according to the colour the student stated in 4.c.

- e. Soil texture name:

The soil texture name will agree with the name in the soil texture triangle outlined in Activity 4 of the Student Module Booklet, based on the amount of sand, silt, and clay contained in the student answer for f.

- f. Sand ____% Silt ____% Clay ____%

- g. Structure:

One of the two choices should be selected.

- h. Porosity: ____%

Answers should be in the area of 25%.

- i. Field Capacity: ____%

Answers should be 5 to 10% less than the percentage given for porosity.

- j. Acidity:

The range of soil pH for agricultural soils in Alberta is usually between 5.0 and 8.5.

- k. Natural vegetation:

These answers should be reasonable for the area where the sample was taken.

1. Crops:

These answers should be reasonable for the area where the sample was taken.

m. Soil Profile sketch:

The soil profile drawn by the student should show topsoil (A-horizon) and subsoil (B-horizon). It may also show the parent material (C-horizon). The level where the soil sample being tested came from should be indicated – in most cases it should be taken from the topsoil level.

n. Soil zone of your sample:

See the map shown on the Soil Report. The soil zone should match the geographical location from which the soil sample was taken.

Section 2: What Happens in the Soil?

This section explores the interactions between soil and living things, and examines the recycling of nutrients in the soil.

Check and discuss the answers to the following activities with your students.

Section 2: Activity 1

1. Describe how plant roots contribute to the survival of land plants.

Roots anchor plants to prevent them from being washed away when it rains, or from toppling over in high winds. Roots also provide a means to obtain moisture and nutrients from the soil.

2. Describe how plant roots help the soil.

Plant roots bind soil particles together to provide structure for the soil, and to help prevent erosion. Tree roots can break up large rocks – this contributes mineral matter to the soil. When the plant dies, the roots add organic matter as well.

Students can observe an example of how osmosis works by placing dried fruit into a glass of water and observing the changes that occur.

3. What will happen to the fruit?

The fruit will expand as water enters it.

As an Extension Activity students can investigate the process of osmosis further by completing “Activity 6: How Can Minerals Affect Plant Growth?” on page 33 of *The Living Soil: A Renewable Resource*.

4. List the visible organisms found in soil.

Burrowing animals such as moles, gophers, and badgers are found in soil, as are smaller organisms like earthworms, roundworms, insects, spiders, slugs, and centipedes.

5. How do the activities of these organisms help the soil?

Burrowing organisms are soil builders – they mix and aerate soil as they dig. Even smaller organisms such as ants can mix soil. The elimination of body wastes from these organisms is a source of organic matter that provides a readily available supply of nutrients.

6. Why are some of these organisms not appreciated by farmers?

They create mounds and holes in fields, or consume part of the crop.

7. What two types of microorganisms decompose organic matter in the soil? Give one example of each kind.

Fungi (yeasts, mildew, moulds, and mushrooms) and bacteria (actinomycetes) decompose organic matter in the soil.

8. How do microorganisms help improve the soil?

Soil microorganisms, such as bacteria and fungi, help improve the soil by decomposing organic matter, which recycles the nutrients removed for plant growth back into the soil. Decomposition also produces humus, a gummy substance that binds soil particles.

As an Extension Activity students can observe the effects of decomposition and see how fast this happens to various materials in the soil by completing “Activity 8: How Does Soil Recycle Organic Matter?” on pages 42 and 43 of *The Living Soil: A Renewable Resource*.

9. Explain how producers, consumers, and decomposers interact within an ecosystem.

Producers, consumers, and decomposers form a cycle within an ecosystem. The producers are green plants which make food for other organisms. Consumers use the plants, or other animals, for food. Eventually plants and animals die and provide food for the decomposers. The resulting nutrients are then available for new plant growth.

10. Which animals in this food web would compete with humans for the use of the land? How?

Mice, rabbits, and grasshoppers compete with humans for the use of the land by eating the field crops that farmers are trying to grow.

11. Which animals would humans find beneficial in this food web? How?

Foxes and insect-eating birds would help humans by keeping harmful creatures under control.

12. What is removed from the soil by plants?

Nutrients are removed from the soil by plants.

13. How are nutrients returned to the soil when the land is farmed?

Nutrients are returned to the soil by returning crop residue (straw) from crops, and animal manure back to the soil. Nutrients are also returned to the soil by the use of commercial fertilizers.

14. How are nutrients returned to the soil in nature?

Animals return the food they eat back to the soil in the form of manure, and living things return nutrients to the soil when they die.

15. The grasses which once covered the prairies protected and enriched the soil with their remains. What protects the soil now?

Crops offer a similar kind of protection to what the grasses once did. Dangers arise when the crops are harvested and the soil is laid bare, or when the crops are unable to withstand harsh conditions (such as low moisture) that grasses are better adapted to handle.

Section 2: Activity 2

1. What is the difference between a macronutrient and a micronutrient?

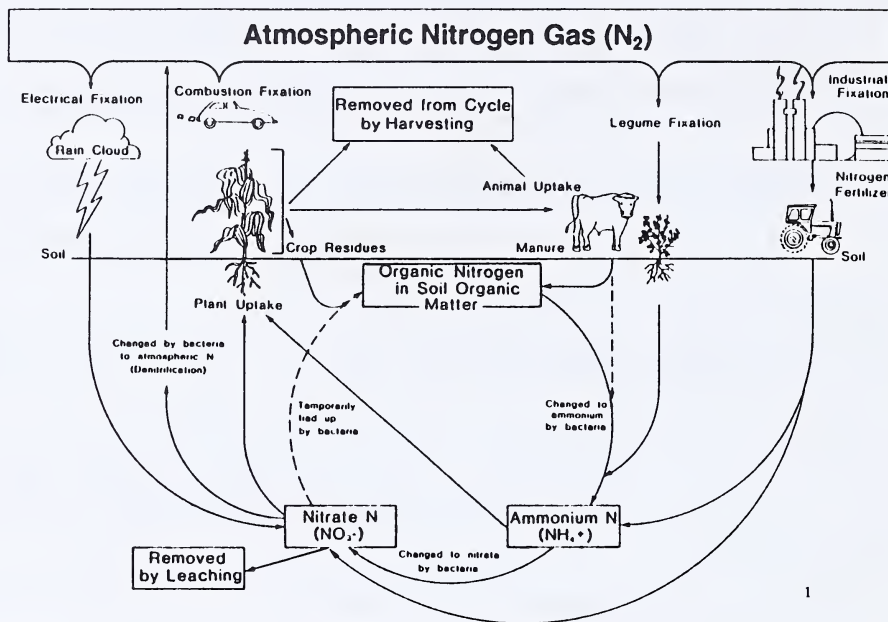
Macronutrients are needed in large quantities, while micronutrients are required in smaller amounts.

2. Name the nine macronutrients that plants require.

carbon
oxygen
sulphur

hydrogen
potassium
magnesium

nitrogen
phosphorus
calcium



3. On the nitrogen cycle diagram, highlight the ways in which nitrogen is taken from the soil. Then list (in the following space) all the ways in which nitrogen is added to the soil to replace what has been lost.

On the diagram students should highlight that the nitrogen is removed from the soil by plant uptake. Nitrogen is lost when crops are harvested as food for plants or livestock. Some nitrogen in the soil is also changed to atmospheric nitrogen.

Nitrogen is added to the soil by the following:

- legume fixation
- industrial fixation (commercial nitrogen fertilizers)
- bacterial fixation from organic matter (manure and crop residues)
- combustion fixation
- electrical fixation

¹ Alberta Agriculture for the chart from *Alberta Soils Course*. Reprinted by permission of Home Studies Section, Education Branch, Alberta Agriculture

4. What would happen to the amount of nitrogen in the soil where legume crops are growing?

The amount of nitrogen would increase.

5. What would happen to the amount of nitrogen in the soil if a non-legume crop were harvested on the same field for several years?

The amount of nitrogen would decrease.

6. What would happen to the amount of nitrogen in the soil if soil bacteria were destroyed by chemicals?

The amount of nitrogen available for plant use in the soil would decrease. Soil bacteria are needed to change nitrogen gas in the soil into a form plants can use.

7. How could this method help the farmer, the plants, and the environment at the same time?

The farmer would save the cost of fertilizer since smaller amounts would be required. Plants would be able to use more of the available phosphorus, and the environment would be helped as the organic matter in the soil would be decomposed and the nutrients would be released for plant growth.

8. How might legumes be used to reduce the amount of nitrogen fertilizer required to grow a non-legume field crop such as wheat?

If a legume crop is planted every few years, it can replenish the nitrogen removed by a non-legume crop.

Section 2: Follow-Up Activities

Extra Help

- Fill in the blanks in the following table to identify the main producers, consumers, and decomposers in the soil ecosystem.

	Example	What Is Consumed or Produced?
producer	<i>plants</i>	<i>Food is produced.</i>
consumer	<i>animals or people</i>	<i>Plant and animal matter is consumed by people. Other animals are consumed by carnivores. Plants are consumed by herbivores.</i>
decomposer	<i>microorganisms</i>	<i>Dead plants and animal bodies are consumed to release nutrients.</i>

- Write the following words either to the left or right of the middle line to show how a balance can be achieved in the soil on a farm.

fertilizer
harvesting crops
plant material
plant nutrients

fertilizer

plant material

fungi and bacteria

animal wastes

fungi and bacteria
soil erosion
livestock feeds
animal wastes

plant nutrients

harvesting crops

livestock feeds

soil erosion

+

additions to the soil

-

subtractions from the soil

Enrichment

Enrichment A

In what ways do earthworms help to keep soil fertile?

Earthworms help to keep soil fertile by

- *digesting and decomposing organic matter*
- *adding animal wastes to the soil for further decomposing*
- *mixing and aerating the soil*

Enrichment B

Even a seemingly barren soil sample will provide evidence of life.

Complete “Activity 5: Is the Soil Alive?”, on pages 28 and 29 of the textbook, to see this evidence for yourself.

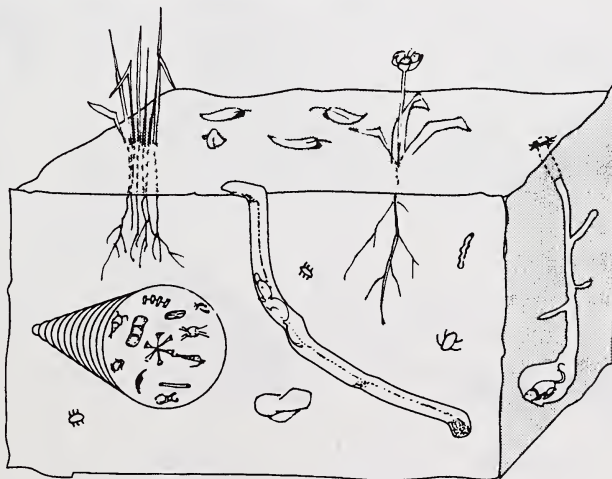
What type of organisms did you find? Describe the evidence that you see.

Algae and bacteria were the types of organisms found. Algae will form a film on the microscope slide, and bacteria will etch the surface of the 35 mm slide.

Enrichment C

Complete “Activity 7: How Can Soil Organisms be Collected?”, on page 35 of the textbook. Then draw what you see in the following space. Be sure to outline the scale of magnification below your diagrams.

Here are some of the organisms that students might see.



25

Section 2 Assignment

1. Describe how each of the following living things enriches the soil. (5)

- a. plant roots

Plant roots are soil builders, and they add organic matter to improve the soil structure.

- b. microorganisms

Microorganisms decompose organic matter to release nutrients.

- c. soil mites and ants

Soil mites and ants mix the soil.

- d. earthworms

Earthworms mix and aerate the soil and fertilize it with castings.

- e. burrowing animals

Burrowing animals mix the soil and fertilize it with manure.

2. Use the names of the organisms shown below, and arrange them into a food web on the following response page. Use lines and arrows to show how each example provides food or nutrients for other organisms. (5)



soil
microorganisms



weed



coyote



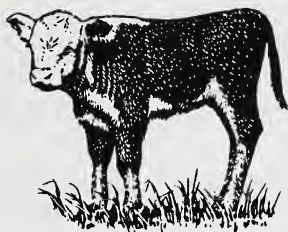
grasshopper



songbird



grain plants



farm animal



mouse

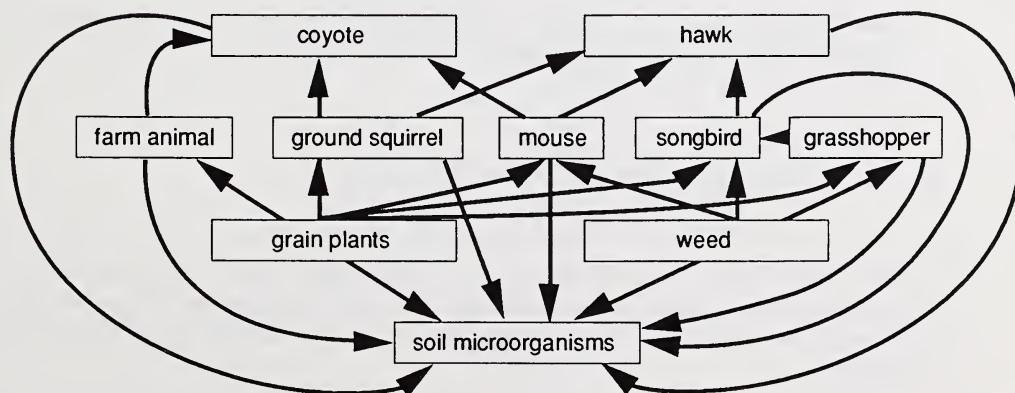


ground squirrel



hawk

Answers will vary. Check to see that the organisms and arrows are arranged reasonably to show how the organisms provide food or nutrients for each other. An example follows.



3. Name the organisms in this food web that people consider beneficial. Why? (3)

The grain plants, farm animal, soil microorganisms, songbird, coyote, and hawk are considered beneficial. Soil microorganisms decompose organic matter, changing it to a form that can be used by plants. Grain and farm animals provide food for people. Songbirds, coyotes, and birds of prey control the number of pests.

4. Name the organisms in this food web that people often consider harmful. Why? (2)

The weed, ground squirrel, mouse, and grasshopper are considered harmful. They are viewed as pests that cause damage to field crops. Coyotes are also sometimes regarded as harmful, because small farm animals can be eaten by them.

5. Do the organisms you named in your answer to question 4 have any beneficial effects? Explain. (2)

Yes, they do have beneficial effects. Reasons will vary but some examples are that weed roots help build soil and hold it in place to prevent erosion, while ground squirrels and mice aerate soil and help crops by eating harmful insects and weed seeds, and insects such as grasshoppers are a source of food for many songbirds.

6. Name two macronutrients that are most often deficient in the soil. Explain how living things help make each of these nutrients available for plants to use. (8)

The two minerals most often missing from soil are nitrogen and phosphorus.

Animal wastes are a type of organic matter that are high in nitrogen, and can be easily broken down by soil microorganisms. Nitrogen is enriched in the soil through the decomposition of organic matter. Special plants called legumes have the ability to work with bacteria to fix nitrogen into the soil.

Some phosphorus that enters the soil as organic matter is released during decomposition. Certain soil bacteria and soil fungi can help by freeing phosphorus that has been tied up by metallic elements present in the soil.

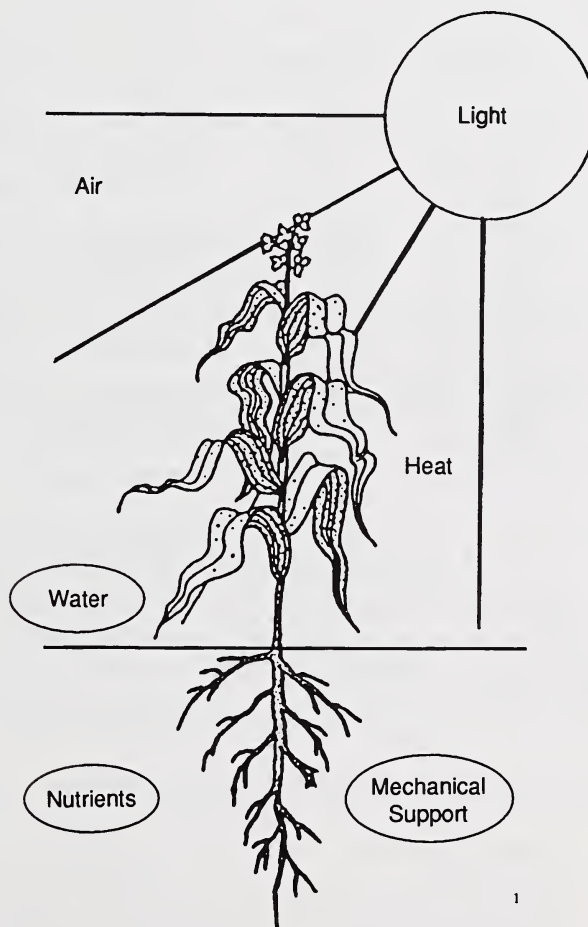
Section 3: Managing Soil for Production

In this section students will examine how soil satisfies plant needs, learn about farm operations that affect the soil, compare different methods used for soil tillage, learn the causes and controls of soil erosion, and see how farmers manage soil nutrients to maximize production.

Check and discuss the answers to the following activities with your students.

Section 3: Activity 1

1. This diagram of a corn plant shows the basic needs of a plant. Circle the basic needs that are satisfied by the soil.

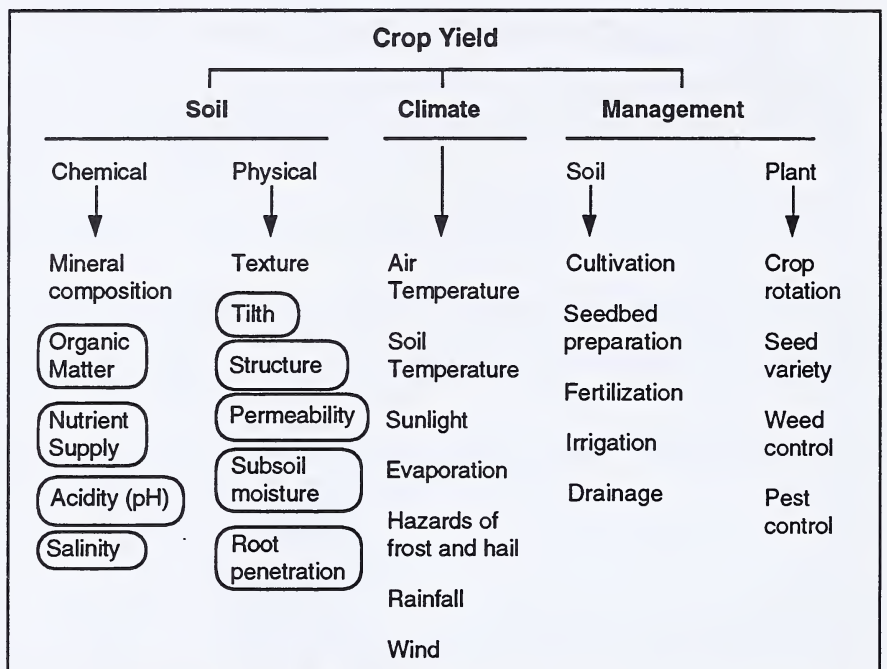


¹ Alberta Agriculture for the graphic from *Alberta Soils Course*. Reprinted by permission of the Home Studies Section, Education Branch, Alberta Agriculture.

2. List the limiting factors that are determined by the soil condition.

A lack of moisture and nutrients, and a poor soil structure are limiting factors.

3. Circle all of the soil factors that a farmer or gardener might control.



The factors that are circled can be controlled by the ways listed under Management. Mineral composition and texture are more difficult to control but they too can be changed over time by such management practices as cultivation, irrigation, fertilization, and crop rotation.

4. What are the four reasons why conventional tillage is used on a farm?

Four reasons for conventional tillage are the following:

- *seedbed preparation*
- *weed control*
- *management of crop residues*
- *moisture conservation*

¹ Alberta Agriculture for the graphic from *Alberta Soils Course*. Adapted by permission of the Home Studies Section, Education Branch, Alberta Agriculture.

5. What are the main uses of tillage during

a. Spring?

Weed control and seedbed preparation are the main uses of tillage during spring.

b. Summer?

A summer use for tillage is weed control.

c. Fall?

Managing crop residue and moisture are main fall uses for tillage.

6. How might summerfallowing reduce a farmer's expenses and increase his or her income?

Summerfallowing means the following:

- *There is a lower cost to fertilize summerfallow fields.*
- *There are no seed costs in the fallow year.*
- *Insects and weeds are eliminated without expensive chemical sprays.*
- *The moisture conserved should result in a better crop in the following year.*

7. Summerfallowing may have economic benefits for some areas, but it also has costs. List costs to both the farmer and the soil.

Summerfallowing costs include

- *an increased risk of soil erosion*
- *a loss of valuable organic matter and nutrients to soil erosion*
- *no income in the fallow year*
- *increased tillage costs*

8. There are many questions that a farmer should answer before considering summerfallow. Can you think of some important questions?

Farmers should consider these questions before summerfallowing:

- *Is this method suited for the climate and soil?*
- *Will the savings be worthwhile?*
- *Is there a potential for soil erosion?*
- *Will moisture savings be significant?*
- *Will yields really increase significantly?*

Section 3: Activity 2

1. How does soil erosion differ from natural erosion?

Soil erosion happens very quickly, is damaging to the environment, and is affected by human activities. Natural erosion occurs slowly and without the influence of human activity.



1

2. Can you explain how the rocks in this picture came to sit on the surface of the soil?

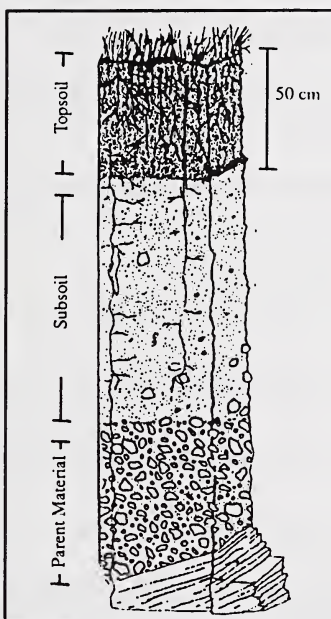
The soil around the rocks has been eroded.

3. Which parts of the soil are eroded? How does this affect the soil?

The small clay particles and light organic matter are eroded first. This affects the soil's fertility, its ability to resist further erosion, and its ability to retain water.

¹ Alberta Agriculture for the photograph. Reprinted by permission of Conservation and Development Branch, Alberta Agriculture.

4. Consider the following soil profile to answer the following questions.



- a. How long would it take to form the topsoil shown in the soil profile diagram if five centimetres of soil forms every 100 years?

It would take 1000 years to form the topsoil.

- b. Suppose that soil is slowly eroding from hilltops on a farm. If one centimetre is lost every year, how long will it take until there is no topsoil left?

It will take between 50 to 55 years. Don't forget that new topsoil is forming at the same time.

- c. What would be an acceptable rate of erosion so that no topsoil is lost?

The rate of erosion should be the same or less than the rate of soil formation, or about five centimetres every 100 years.

Students can obtain the answers to questions 5 to 8 in one of two ways:

- by watching videotapes to learn about soil erosion and how it can be controlled
- by reading information in the Student Module Booklet about the methods used to prevent soil erosion

The following videotapes are about controlling soil erosion:

- *Gone with the Wind – Too!*
- *Oh! Gully! Where is the Soil?*

5. How can plants be used to protect the soil from erosion?

Trees can create shelterbelts, strips of crops can trap moving soil, and grasses or crops can cover the soil.

6. How does crop residue help control soil erosion?

Crop residue provides a protective cover for the soil, and adds organic matter to help the soil hold moisture and resist erosion. The residue eventually breaks down to form humus, which acts as a glue to hold soil particles together.

7. Tilling should be avoided when the soil is dry. Why?

Dry soil is more easily eroded, especially when it is disturbed by tillage, which also increases evaporation losses by bringing moist soil to the surface.

8. Suppose you are a farmer considering a switch from conventional tillage methods to zero tillage. Compare the advantages and disadvantages of a change to zero tillage.

Advantages

- *little soil erosion*
- *lower fuel costs due to fewer tillage operations*

Disadvantages

- *heavier equipment required*
- *equipment is more costly*
- *more herbicides required*
- *weed control is less effective*

Section 3: Activity 3

1. How much of each nutrient is present in a fertilizer with the number (16-20-0-14)?

Nitrogen: 16%

Phosphate: 20%

Potash: 0%

Sulphur: 14%

2. What are the advantages of placing fertilizer and seeds into the ground in one operation?

Putting fertilizer and seeds into the ground at the same time is useful, due to the following:

- *It is efficient – it saves time, energy, and labour.*
- *The fertilizer is placed where it can be easily obtained by the plant.*

3. If manure is a low-quality source of plant nutrients, why is it still considered a good fertilizer?

The true value of manure lies in its ability to replace lost organic matter in the soil, and to serve as a supply of nutrients as it slowly decomposes. If done properly, the application of manure to the soil is an environmentally sound method of disposal.

4. How can soil testing help the Jones' farm?

Soil tests outline the type and amount of fertilizer to apply. Tests can also indicate other soil problems that may affect productivity, such as acidic, alkaline, or saline conditions, or poor structure. Testing the soil can prevent an unnecessary use of fertilizer, and point the way to other measures that may produce a better crop.

5. Does the use of fertilizer pay? Please show your calculations for 5. a. and 5. b. in the allotted space.

- a. Mr. Jones plans to use a nitrogen fertilizer for the barley crop. Mrs. Jones has calculated that it will cost \$18/acre for this fertilizer. The field should produce an extra 20 bushels/acre. If they receive \$2/bushel for the extra grain, will this pay for the fertilizer? How much would their earnings increase on each acre?

<i>Increased income per acre = 20 × \$2 =</i>	<i>\$ 40</i>
<i>less cost of fertilizer</i>	<i>\$ 18</i>
<i>equals increased earnings per acre</i>	<i>\$ 22</i>

- b. What would their added earnings be if the barley price dropped to \$1/bushel.

<i>Value of increased production</i>	$= 20 \times \$ 1 =$	\$ 20
<i>less cost of fertilizer</i>		\$ 18
<i>equals increased earnings per acre</i>		\$ 2

In this case the Jones' stand to make only \$2 per acre. This may not be enough to make an application of fertilizer worthwhile.

6. What are two factors that determine whether a farmer should apply fertilizer to a crop?

Two factors are the following:

- *Soil test results – Is the soil deficient in one or more nutrients?*
- *Economic factors – Will it be profitable to apply fertilizer?*

7. Referring back to Section 2: Activity 2 of this module, do you remember what a legume crop is? How would these plants help the soil if they were cultivated every third year of a three-year crop rotation?

Legumes are plants such as peas, beans, and clover that have nodules on their roots which contain nitrogen-fixing bacteria. Legumes add nitrogen to the soil through their interaction with soil bacteria, and they add organic matter if they are tilled into the soil instead of being harvested. This enriches the soil so that other field crops can grow better in the other years of the crop rotation cycle.

Follow-Up Activities

Extra Help

Complete the following by filling in the blanks with the correct words from this section.

Plants have several needs which can be satisfied by the soil. These include *moisture*, *nutrients*, and *mechanical support*. If these needs are not met, they will limit plant growth. Because of this they are called *limiting factors*.

Tillage is the mechanical mixing of the soil. It is a large part of farming and is used for *seedbed* preparation, *weed* control, managing crop *residues*, and *moisture* conservation.

Summerfallow (an unseeded field) is a method used to conserve moisture in the soil from the previous season so that a better crop can be grown. This method requires a lot of *tillage* to control weeds. Over many years, this practice has resulted in a reduction of *organic matter* in the soil. Loss of the vegetation cover and less organic matter increases the risk of *soil erosion*.

Soil erosion is the removal of topsoil by *wind* and *water*. Soil can be sheltered from the direct force of the wind with shelterbelts. Moving soil can be trapped using strip farming methods. Soil can be protected by covering it with *grass*, *crops*, or *crop residue*.

Conservation tillage includes the many ways that farmers can till their land for soil *conservation*. In general, this practice means leaving a cover of *vegetation* on the soil, using less *tillage*, shallow *depths*, and slower *speeds*.

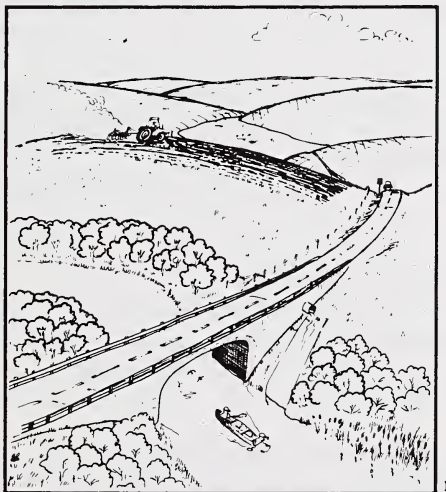
Tilling when the soil is *dry* should also be avoided. With *zero* tillage, some farmers plant and harvest a crop with no tillage at all. Specially designed seeders plant the seeds through the stubble of the previous year's crop.

When a particular nutrient is in short supply, it is said to be *deficient*. A *fertilizer* is any substance which contains plant nutrients and can be added to the soil to encourage plant growth. If soil testing suggests that nutrients are in short supply, two types of fertilizer may be applied: *organic* fertilizers and *chemical* fertilizers.

Changing the crops grown on a field can have benefits for the *soil*. This is called *crop rotation*. This method may reduce the potential for erosion and add organic matter to the soil. Sweet clover or legumes that are grown, but not harvested, become green *manure*.

Enrichment

Enrichment A



After examining the previous illustration, make a list of all the places where eroded soil may go.

Soil that is removed from the land can go anywhere. Winds may carry it hundreds of kilometres. It can blow into woodlands, a neighbour's field, or collect in a roadside ditch. Runoff water deposits soil in lakes, ponds, streams and low spots on the land. Streams and rivers carry soil to lakes or to the sea. If it can be done at all, reclaiming soil is an expensive process.

¹ Alberta Agriculture for the graphic from *Conserving Soil for a New Generation*. Reprinted by permission of Soil and Water Conservation Branch, Alberta Agriculture.

Enrichment B

Look for information on composting. Come up with a design for your own composter. Describe how you will maintain the pile, and what you will do with the “fertilizer” that you make.

This is a project that may be started in the winter but will progress best during the summer. Have your students research and prepare a design for their pile. Answers will vary.

25

Section 3 Assignment

1. Meeting plant needs is a part of soil management for both farms and gardens. (6)

Name three plant needs that are satisfied by soil and describe how soil can be managed to ensure that each of these needs are met.

Moisture – Soil can be managed by summerfallow, irrigation, drainage, and trapping snowfall.

Nutrients – Management of the soil can be done by soil testing, fertilizer application, preventing soil erosion, and by adding organic matter.

Mechanical support – Soil can be managed by tillage to improve the soil structure for seeding, and to prevent soil erosion.

2. How could you solve these soil erosion problems? Select an appropriate solution for each of the seven problems listed. Describe how your solution would help. In most cases, more than one method would work. (7)

Problems	Solutions
a. Gully erosion on a waterway	Cover crop
b. Rill erosion on a sloped field	Strip farming
c. Sheet erosion on a fallow field	Grass cover
d. Soil blowing while a field is being tilled	Minimum tillage
e. Soil drifting on summerfallow	Shelterbelts
f. Soil creep of unprotected soil	Contour farming
g. Soil blowing from a field during winter	Zero tillage

- a. *Grass cover on the waterway will hold the soil in place and slow the flow of water.*
 - b. *Contour farming will slow the water flow and increase the infiltration of runoff into the ground.*
 - c. *Contour farming will create barriers to capture soil and slow the flow of water.*
 - d. *Use minimum tillage and avoid tilling where the soil is dry to prevent blowing soil.*
 - e. *Shelterbelts or strip farming will create barriers to slow the wind and trap snow to increase soil moisture.*
 - f. *The use of shelterbelts and strip farming will help break the force of wind and be effective in reducing soil creep.*
 - g. *Cover crops will hold soil together and protect it from being blown away by winter winds.*
3. Besides adequate moisture and temperature, plants must have sufficient nutrients for proper growth. Soil is a storehouse of nutrients for plants to use. But not all soils contain all of the necessary nutrients (in adequate amounts) needed for the best possible growth of the plants. To improve the nutrient supplies in the soil, farmers and gardeners have several options. They may
- apply commercial fertilizers
 - grow legume crops
 - apply organic fertilizers
 - add lime to reduce acidity
 - improve drainage
 - use conservation tillage methods
 - use deep tillage
 - eliminate summerfallow

How would you solve soil problems involving a lack of nutrients? For each of the following problems suggest how you might maintain or improve the soil and/or increase the available nutrients. You may use any of the methods listed above that are appropriate. Some problems may need a combination of methods. (12)

Answers will vary. In some cases students may name some methods that are not listed in the Assignment Booklet. This is acceptable as long as the methods named are appropriate. Some sample answers follow.

- a. Nutrients are removed from the soil ecosystem when crops are harvested.

Replace nutrients with commercial fertilizer or grow legume crops as part of a crop rotation cycle. Use conservation tillage methods to keep crop residue on the field to replace lost organic matter and to recycle nutrients.

- b. The climate and vegetation (as in some forested areas) may not encourage organic matter to accumulate as topsoil.

Apply chemical fertilizer and add organic matter to supply nutrients and improve the soil structure. Lime is needed to reduce acidity.

- c. Soil erosion removes the fine particles or light organic matter that contains most of the available nutrients.

Use conservation tillage and other similar methods to prevent soil erosion. Use a cover of vegetation or "trash cover" to protect the soil. Eliminating summerfallow will also help prevent soil erosion.

- d. In poorly drained areas soil bacteria may de-nitrify soil by converting soil nitrates to atmospheric nitrogen.

Improving drainage will help solve the problem.

- e. In acidic soils, such as the luvisolic soils, nutrients are leached from the topsoil by acidic water as it percolates downward.

Luvisolic soils are low in nutrients – for this reason they are poorly suited for agriculture. You might improve the soil with chemical and organic fertilizers, and organic matter. Adding lime will reduce acidity and slow the leaching of nutrients.

- f. The parent material on which the soil formed may not contain all of the possible nutrients.

Apply chemical or organic fertilizers to add nutrients to the soil.

Section 4: Conserving Soil for the Future

In this section students will investigate the resources necessary for food production. They will also learn how the soil resource can be degraded on the prairies and around the world. Students will consider the meaning of sustainable agriculture, and investigate alternative farming practices.

Check and discuss the answers to the following activities with your students.

Section 4: Activity 1

1. List several of the renewable and non-renewable resources mentioned in your textbook that a farmer requires to produce food.

Non-renewable Resources	Renewable Resources
oil (for fuel)	water
natural gas	soil
coal (for power)	air
phosphorus (Although they are not mentioned in the textbook, phosphorus and other minerals are needed for plant growth.)	solar energy (Although it is not mentioned in the textbook, solar energy is necessary for plant growth.)

2. Explain why the conservation of renewable and non-renewable resources is important.

There is a limited supply of non-renewable resources. Even renewable resources can be lost if they are not maintained.

3. How did the settling of the prairies by large numbers of farmers affect the natural prairie ecosystem?

Prairie soils are not as fertile as they once were because natural plant cover has been ploughed up. Ploughing exposed the topsoil to wind and water erosion. The growth of new crops decreased the organic content of the soil as more nutrients were taken from the soil than were returned to it. Also, some of the most fertile soils are no longer used for farming – towns and cities are located on these soils.

4. Where could people grow their food if not in the soil? What is the main problem with alternative methods?

Food from the sea or hydroponic growing methods are possible suggestions, but these methods are limited in the amount of food that they can ultimately produce. Hydroponics is also costly, energy dependent, and labour intensive. However, both methods will provide welcome additions in the future.

5. List several land use or farming practices that can degrade the soil.

Soil can be degraded by the following land uses or farming practices:

- building housing subdivisions, acreages, shopping centres, and roads
- soil erosion can remove topsoil
- the salinization of the soil
- the loss of soil nutrients

6. Why is it important to increase the productivity of poorer soils?

These soils will be needed to feed the growing population of the world, and to replace agricultural land that is permanently lost to other uses.

Section 4: Activity 2

1. Can you guess what is the most effective soil erosion control?

Maintaining a cover of vegetation to protect the soil is the most effective soil erosion control.

2. Suppose lime costs are \$30/tonne and each hectare of land requires five tonnes. An application of lime can last ten years and increase the crop yield by 25 bushels per hectare. If the crop is worth \$3 per bushel, how long will it take to pay for the lime? Use the following space to show your calculations.

The cost of lime per hectare = $\$30 \times 5 = \$150$ per hectare.

Extra income each year per hectare = $25 \times \$3 = \$75$ per hectare.

The time required to pay back the cost of lime is $150 \div 75 = 2$ years.

3. Why might farmers be unable to use lime on their acidic soils? Suggest several reasons.

Lime may not be available or it may be too expensive to transport and apply to the soil in the proper quantities. Applying large amounts of lime (such as five tonnes per hectare) would require special equipment.

4. a. What type of fertilizer is used in Canada?

Commercial fertilizers are readily available and widely used in Canada, although organic fertilizers (manure) are also used when they are available.

- b. What type of fertilizer is used in a non-industrial country?

Organic fertilizers, which are low in available nutrients, are more common in non-industrial countries.

- c. What country has the most productive fields?

Agricultural land in Canada is among the most productive in the world.

5. Why is the prevention of soil salinity important?

Soil salinity reduces a farmer's income by making his or her land less productive, and it threatens the food supply by making the land unproductive. Rehabilitating the land is a costly process.

6. How might this situation be considered a serious threat to food production?

Urbanization reduces the amount of land available for food production, and it also consumes the best land. Food must then be grown on poorer land.

7. How is deforestation similar to other causes of soil erosion?

The removal of the vegetation cover has left the soil unprotected.

8. Why is it important to protect the soil from chemical pollution?

Soil needs to be protected because it is where people grow their food. Birth defects and increased cancer rates are reported in countries like Poland, where uncontrolled industrial pollution has seriously contaminated the soil. The soil provides food for many organisms that are part of the food chain.

9. What are the common causes of desertification around the world?

Drought, wind erosion, and overgrazing are causes of desertification.

Section 4: Activity 3

1. a. Do the comments you just read seem like a sustainable system of production?

Answers will vary. There is no single answer.

- b. Why or why not?

As long as there are natural resources such as fertilizer and lime, the land can continue to produce indefinitely. However, if these resources are in short supply, the condition of the land will rapidly deteriorate. Problems not related to such things as climate may be overcome.

Students can obtain the answers to questions 2 to 7 by one or both of the following methods.

- View the videotape *A Sense of Humus* to see how several farmers have embraced a different style of farming. Students should be aware that this is a controversial film because some of the claims made by organic farmers are difficult to prove or disprove. If students view this video, they should try to see if they agree or disagree with some of the claims made by the farmers.
- Read “Case Study: Organic Farming” which starts on page 58 of *The Living Soil: A Renewable Resource*.

2. What types of plant and animal materials can act as nitrogen fertilizer?

Animal manure and plant residue break down to release nitrogen into the soil. Legume crops such as peas, clover, alfalfa, and beans add nitrogen to the soil.

3. How can some weed pests be controlled without the use of pesticides?

Plants such as fall rye, oats, rye, peas, and sunflowers discourage the growth of certain weeds. By cultivating the soil, early weed growth is encouraged. These weeds are then removed by tilling the soil again just prior to planting the seed later than most conventional farmers.

4. Can you think of some of the problems associated with these methods?

Problems include the following:

- *These methods are not geared to high levels of productivity, and require a lot of labour.*
- *Much management time is required.*
- *Results are not predictable since the nutrient content of fertilizer is difficult to predict.*
- *Pest control may be less successful without chemicals.*

5. Is organic farming more sustainable than conventional (monoculture) farming?

The common perception is yes, because organic farming uses fewer non-renewable resources. However, organic matter is a low-quality fertilizer that cannot support high levels of productivity. Without replacing the nutrients that are removed by crops, the quality of the soil will suffer. Also, more tillage is needed to control weeds – this leaves the soil more open to erosion.

6. Answer **true** or **false** to the following statements in the spaces to the right of each comment. The systems or methods referred to are organic and conventional farming methods.

a. Both systems conserve soil by replacing organic matter, recycling nutrients, and taking steps to prevent soil erosion.	<i>True</i>
b. Both systems use renewable natural resources.	<i>True</i>
c. Both use chemical pesticides.	<i>False</i>
d. Both methods claim high levels of productivity from soils.	<i>True</i>
e. Both systems use minimum amounts of non-renewable resources such as commercial fertilizers.	<i>False</i>
f. Both remove the same amount of nutrients from the soil when the same amount of crops are harvested.	<i>True</i>
g. Both methods must replace the nutrients that are removed from the soil, or the soil will be less fertile.	<i>True</i>

7. Based on the answers to question 6., what are the main differences between conventional and organic farming?

Organic farmers do not use chemical pesticides, and they utilize a minimum of commercial fertilizers.

Follow-Up Activities

Extra Help

The concept of sustainable agriculture implies several things. Circle the words in the following list that apply to it.

lasting

non-renewable

renewable

recycling

eroded

polluted

conservation

continuing

urbanization

degraded

Enrichment

Enrichment A

1. Which plants survived the longest?

Plants which receive the least salt will last longer than plants that obtain more salt.

2. Which plants germinated (sprouted) most quickly?

The seeds which receive normal water should germinate first. Increased salt will slow the germination of plants. Some plants receiving salted water will not germinate at all.

As an Extension Activity, some students may try growing several types of plants in salty soils to see which plants have a higher tolerance to salt.

Enrichment B

You are a member of a United Nations committee that is meeting to discuss the worldwide problem of soil erosion. Various people have described difficulties in their countries. They are asking members of the committee (including you!) for solutions.

What are your solutions?

Problem 1: *The best solution to this problem is to stop the clearing of land – it is unsuited for agriculture.*

Problem 2: Without a supply of water the process can be slowed, but not stopped, with windbreaks and trash cover. The area is so large that massive irrigation is required to stop the spread of the desert.

Problem 3: Reforestation and terracing would reduce the amount of runoff from steep mountain slopes. This would reduce the amount of erosion from hillsides and lessen the seriousness of flooding in the lowlands.

25

Section 4 Assignment

Research and write a report on a world soil problem. You may research a country of your choice or one of the countries mentioned in Section 4. Many books and magazines are available for you to read descriptions of soil problems in Canada or other countries. Your school library may have one of the following publications which could aid your research:

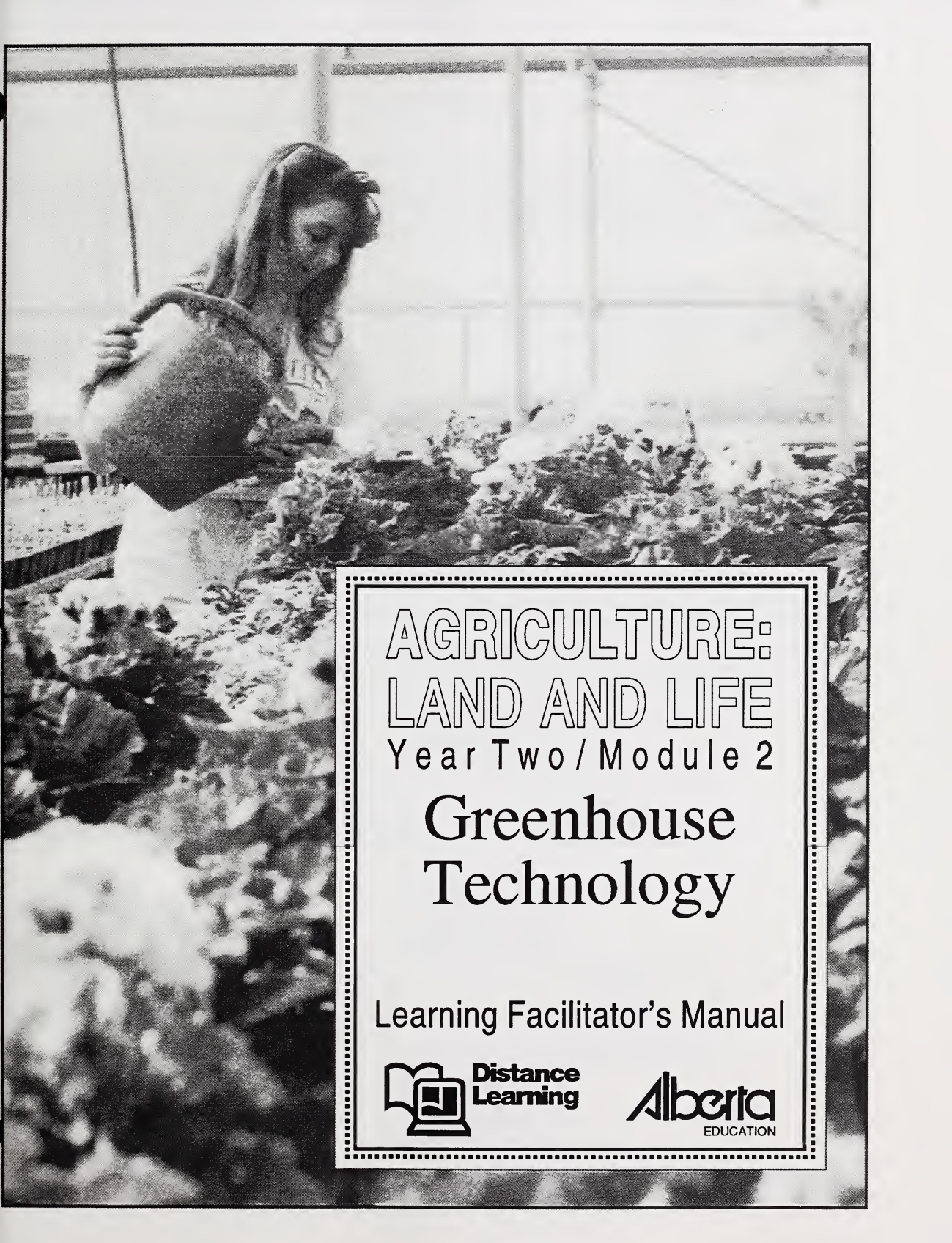
- *National Geographic*
- *Canadian Geographical Journal*
- *Environment Views*

Include the following in your report:

- a. Draw a map showing where the affected areas are located. (3)
- b. Write a description of the soil problem. (5)
- c. Write a description of the main causes of the problem. (5)
- d. Explain why the agriculture in these soils is not sustainable. (5)
- e. What solutions are suggested? What solutions do you propose? (5)
- f. Note the names of books and magazines you used for reference, other than your Module Booklet. (2)

Answers will vary. Use the marking key beside each question to evaluate the student reports.

A final grading for Module 1 can be determined at this point.



AGRICULTURE: LAND AND LIFE

Year Two / Module 2

Greenhouse Technology

Learning Facilitator's Manual



**Distance
Learning**

Alberta
EDUCATION

Module 2: Greenhouse Technology – Overview

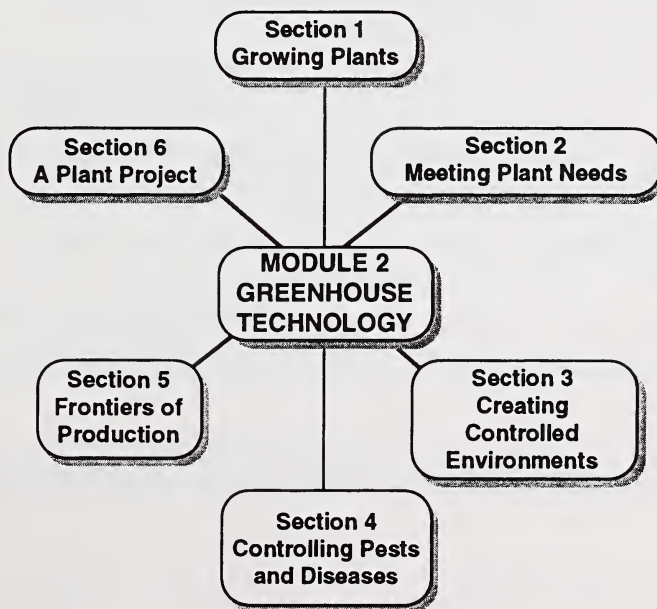
Farming can be thought of as a series of interventions in a natural process to maximize crop production. The growing of plants – both commercially and in the home – requires a high degree of skill and responsiveness to plant needs. Such decisions as how and when to seed, when to fertilize, or how to control pests and diseases, depend on a range of conditions that need to be monitored in order for appropriate action to be taken.

Horticulture is the growing of plants whereby each plant receives individual attention. This topic is well suited to individual study and provides an opportunity to study plant growth in a controlled indoor environment. Greenhouse technology employs principles similar to those of growing plants in larger structures.

It is hoped that students will take advantage of the many opportunities for hands-on experiences with plants presented in this module. Because this module is about growing plants, Section 6: A Plant Project has also been included. Students may begin their plant project after completing Section 2 of this module.

In this module students will

- discover the many ways that plants can be propagated
- recognize that plants have needs that must be filled for optimum growth
- learn how to monitor and manage environmental conditions in a home to satisfy plant needs
- find out how environments are monitored and managed in greenhouses and growth structures
- meet some common plant pests and learn about pest controls
- speculate how new developments in greenhouse technology might provide benefits



Evaluation

The student's successful completion of all assignments in the Assignment Booklet will depend on practice obtained while doing the various activities in the Student Module Booklet. In this module students are expected to complete five section assignments.

The following distribution of marks is suggested in determining the student's grading for this module.

Section 1 Assignment	25%
Section 2 Assignment	25%
Section 3 Assignment	25%
Section 4 Assignment	15%
Section 5 Assignment	10%
TOTAL	100%

Note: The evaluation of the assignments for this module does not include an evaluation of Section 6: A Plant Project. The project is to be evaluated as part of Module 4.

Although the value of each module for the Agriculture: Land and Life Year Two course is the decision of the classroom teacher, it is suggested that Module 2 be worth 25% of the total final grade, based on an equal weighting of the four modules in this course.

Project Work

If this is the first year that the student is in the Agriculture: Land and Life program, then the student does not need to complete Section 6: A Plant Project. Instead, Part A of Module 4: What Is Agriculture? will need to be completed.

If the student has previously taken Year One of the Agriculture: Land and Life program, then he or she has an opportunity to pursue an interest in particular topics during the Year Two program. Students are expected to complete two individual projects as part of the requirements for this course. Descriptions for a plant project (Project 1) are included as part of this module, and descriptions for an animal project (Project 2) are included as part of Module 3. Approximately 7.5 hours are allowed for the book work for each project. The actual time spent pursuing each of the projects will be more than 7.5 hours.

In Section 6 of the module booklet, students will find instructions on how to complete a plant project of their choice. A report on the project will be submitted in the Module 4 Assignment Booklet, Part B.

There are 50 marks for the plant project. The following is a breakdown of marks for the plant project assignments that are to be submitted in the Module 4 Assignment Booklet, Part B.

Assignment	Value
Project 1: Section 1	5
Project 1: Section 2	5
Project 1: Section 3	15 or 5
Project 1: Section 4	20 or 30
Project 1: Section 5	5
TOTAL MARK	50

Materials Needed for Module 2

This module has been designed to provide students with many opportunities for hands-on activities with plants.

In order to assist students effectively in their study of this module, it may be helpful to preview Module 2. This will give you an idea of how the topics are developed; it will also give you an overview of the materials needed in the module. In some cases, if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student, so that the activities can be completed successfully.

If students are working on this module in the spring or fall, there should be no trouble finding the materials needed for the activities. However, if this module is worked on in the winter, some advance planning will be required. Some materials should be collected ahead of time so they are available when needed.

1. Several types of plants should be collected, pressed, and dried in the fall. Later on, students can have a closer look at these plants.
2. Seeds from various plants (wild plants, field crops, garden vegetables, or flowers) that students would like to grow under controlled conditions in indoor environments should be gathered.
3. Several litres of garden soil and other growing mediums such as vermiculite, peat, and perlite, will be needed to make potting soil and to compare soil to soilless mixes. As an alternative, premixed potting soil may be purchased.
4. Containers (plastic starting trays or small flower pots) for growing plants will be needed.

Media

To obtain the videotape resources for this module, contact either your regional media centre or the ACCESS Network.

The video program suggested as an optional learning pathway in this module is *Pest Wars*, a 28-minute VHS videotape.

Section 1: Growing Plants

This section contains enough basic botany for students to be able to propagate plants for further activities or projects. For further information they are referred to the Grade 8 science program. This material is covered in much more detail in the Grade 8 science unit – Growing Plants.

Section 1: Activity 1

Note: Students are to do either Part A or Part B.

Part A

If working alone, the student should obtain a garden plant or weed and compare the parts of the plant to the plant pictured in the Student Module Booklet.

If students are part of a class, they should try to study examples of various plants found around the school. If possible, they should study wild plants rather than cultivated plants.

1. Draw a picture of your plant. Name all of its main parts.

Drawings will vary depending on what plant the student selects, but the plant drawing should have the main parts labelled, such as roots, stems, leaves, and flowers. Other parts that may be labelled on the diagram could include root hairs, leaf stems, true stems, woody stems (trunk), horizontal stems, stems and runners, bulbs or tuberous roots, fleshy roots, and flowers of various types. The various reproductive parts of flowers may be shown.

2. Describe how each part is important to the plant.

Students should note a description of the importance of each part that they labelled on the plant in question 1. Answers will vary. Some sample answers follow:

- *Flowers contain reproductive parts which are important for the reproduction of plants.*
- *Leaves manufacture food by the process of photosynthesis.*
- *Stems transport nutrients and support the leaves.*
- *Roots anchor the plants and take up water and minerals from the soil.*
- *Horizontal stems or runners help to make new plants.*

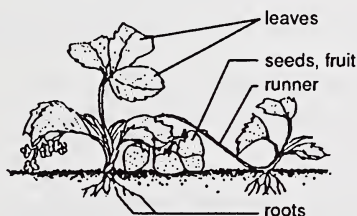
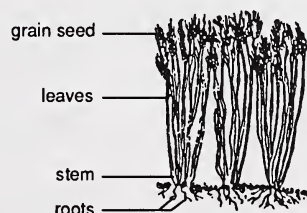
3. Why do you think there are so many different plants?

Answers will vary. Different plant parts have a variety of functions which allow different plants to become adapted to grow and survive in varying environmental conditions. Plants are grown for many different purposes – people may grow plants for food purposes or for cultural beauty.

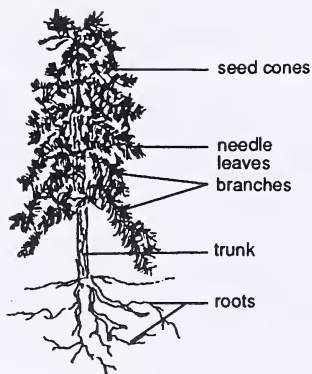
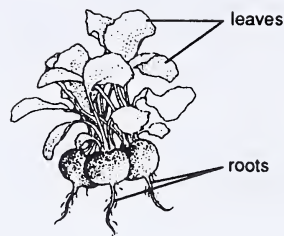
In a classroom situation ask students to identify the parts of the plants with the same function and describe how the part might help a plant to survive.

Part B

4. Examine the drawings of the following plants and name the parts of each plant which provide each listed function. (Some parts are not labelled on the drawings.)

**Strawberry Plant****Wheat**

• Photosynthesis	<u>leaves</u>	<u>leaves</u>
• Nutrient uptake	<u>roots</u>	<u>roots</u>
• Food storage	<u>fruit, roots</u>	<u>grain seed</u>
• Support	<u>stem, runner, roots</u>	<u>stem, leaves, roots</u>
• Transport of nutrients	<u>stem, runners</u>	<u>stem, leaves</u>
• Reproduction	<u>seeds, fruit, runners</u>	<u>grain seed, tillers</u>

**Pine Tree****Beet**

• Photosynthesis	<u>needle leaves</u>	<u>leaves</u>
• Nutrient uptake	<u>roots</u>	<u>roots</u>
• Food storage	<u>needle leaves</u>	<u>roots</u>
• Support	<u>trunk, woody stems, roots</u>	<u>roots, stems</u>
• Transport of nutrients	<u>trunk, branches</u>	<u>stems, leaves</u>
• Reproduction	<u>seed cones</u>	<u>flower</u>

5. List and classify the common plants around your home. Seed catalogues, gardening books, or encyclopedias will help you provide this information.

Plants which prefer to propagate by seed are often annuals, while vegetables with fleshy roots are often biennials. Woody plants and any plants that propagate from bulbs are generally perennials. Many examples can be identified from books on home gardening. The following are some of the more common examples. Students are to list only six examples for each group.

Annuals

carnation
snapdragon
marigold
petunia
alyssum
wax begonia
beans
lettuce
wheat

Biennials

English daisy
foxglove
mullein
pansy
cabbage
beet
carrot
turnip
parsnip

Perennials

lily (many kinds)
delphinium
rose
iris (many kinds)
gladiolus (many kinds)
tulip
peonies
chives
rhubarb

Section 1: Activity 2

1. Write a short paragraph describing the changes you would notice in your environment if plants did not propagate. Which plants would disappear first? How might this affect you?

The first plants to disappear would be the annuals and biennials, followed by the shorter-lived perennial plants. The effect would include a buildup of CO₂ and a reduction of O₂ in the atmosphere. Food supplies from plants and animals would also disappear.

2. If you doubt that bulbs or tubers are stems, try leaving one out in the bright sunlight. It will turn green! Why is this?

The chlorophyll in the bulb or tuber (which is really a modified stem) will be activated by sunlight and begin to produce food. The bulb or tuber will take on a green colour.

3. Various plants are shown on the following page. Examine the pictures, and answer the following questions.

- a. Name the propagation method being used by each of the plants shown.

- **flowering annual plant** – seeds
- **gladiolus** –bulb
- **potato** – tuber
- **spider plant** – runners
- **Aspen tree** – suckers, seeds

- b. Which type or types of propagation shown will produce plants with the characteristics of two parent plants?

Flowering annual plants will produce plants with the characteristics of two parent plants.

- c. Which type or types of propagation will produce plants that are most similar to the parent?

The types of propagation that will produce plants most similar to the parent are those with bulbs, tubers, runners, and suckers.

4. Suppose you need a large number of plants for flower beds in the spring. Which propagation method would you use?

Propagate from seeds if the number of plants are more important than the speed at which they are grown.

5. A fern is getting too large for your home. What could you do to save the plant?

You could divide the root ball and repot the fern divisions into smaller containers.

6. Your younger brother or sister broke a branch off your mother's favourite plant. How could you use the broken branch for propagation?

You could propagate a new plant by using the branch as a stem cutting.

7. You would like to grow a new plant from an original plant as quickly as possible. How would you do it?

Many plants, particularly perennial plants, are started more quickly from leaf cuttings or stem cuttings. Gather slips from branches and allow the slips to root in a soilless starting medium.

Section 1: Activity 3

In this activity students will be given an opportunity to try growing new plants. They will need to use the information from Activity 2 to choose methods of plant propagation that they would like to try. The Appendix at the back of the Student Module Booklet lists plants that are best suited for each propagation method, but additional ideas can be obtained from gardening books found in the library. Extra Help in this section suggests ways for students to locate starting materials for propagation activities.

The number of plants to propagate by each of the chosen methods will depend on the needs of the project that the student wishes to do. It is always better to have too many plants rather than not enough.

Refer students to the Project Section (Section 6). They may want to propagate a particular type of plant for one of these projects. They may start these plants now. You may also want to start a large number of similar plants for a large group of students to use in their projects.

Choosing Your Methods

Use the information from the previous activity to help you choose two methods of plant propagation. You will also grow some plants from seed as a third method.

1. Write down your choices. If you have a particular plant in mind, name this plant.
 - a. Your Choice of Propagation Methods
 - b. Names of Plants
 - c. How will you obtain your seeds or plant materials?

Answers will vary for a, b, and c.

Gather Your Materials

Students will check and discuss their plant propagation choices with the learning facilitator. Check to see that their objectives can be achieved. In the Appendix you will find a detailed description of eight ways in which plants can be propagated. Check to see that the students have gathered the necessary materials to complete this activity.

Make Your Own Starting Medium

2. Write down the recipe that you plan to use.

Answers will vary. Students will show their soilless mix to the learning facilitator and explain how it was made. Descriptions of various soilless mixes, along with guidance on how to make various starting mediums, are outlined in the Student Module Booklet.

3. Propagate your plants using the three methods that you have chosen and the starting medium or mediums that you have made. If necessary, read the appropriate sections of the Appendix.

Students will demonstrate and discuss their three methods of propagating plants with their learning facilitator.

Ask your students to fill in the appropriate sections of the Plant Journal in the back of their Module 2 Assignment Booklet, using one page for each type of plant that they propagate. While the plants are germinating students should continue working on other activities in their module booklets. They will be given frequent reminders to check on the progress of their plants, and to record the progress of their propagating plants in the Plant Journal.

Section 1: Follow-up Activities

Extra Help

If students are having trouble locating starting materials for propagation activities, they may find the following suggestions useful.

- Extract seeds from a tomato, cucumber, wild oats, or another available plant, or use dry mustard seeds or dried beans.
- Take a potato and cut it with a knife so that you have about a 2.5 to 5 cm cube of potato with one eye (dimple) in it. This will act as propagation by tuber.
- Plant a small onion (bulb) for propagation by bulb.

Note: Seeds from a fruit are difficult to germinate and the plants grow very slowly. Students would need to plant many seeds and be prepared to wait a long time. As a result, fruit seeds are not recommended for these activities.

Test Yourself

1. Propagation means to

multiply or make more of something

2. What are two advantages of using soilless mixes to start or grow plants?

Sample answers follow:

- *They are free of insect pests and diseases.*
- *They are free of weed seeds.*
- *They are easier to work with for the above reasons.*

3. What can a soilless mix for plants be made out of?

A soilless mix for plants can be made of coarse sand, perlite, peat, vermiculite, synthetic media such as rock wool, cellulose, sawdust, or any other porous medium.

Check to see that students have attempted to propagate some plants.

Watching plants grow is a main component of this module. Everyone should be able to start plants with the methods presented. In extreme situations you may have to help students by supplying materials or helping with the physical demands of the activities. Observe student activities if possible.

Enrichment

Enrichment A

1. Which mediums failed to produce a plant?

Seeds may have trouble germinating in dry, compacted, or acidic environments.

2. Which mediums resulted in the fastest germination?

Seeds will germinate fastest in moist environments.

3. Which mediums remained moist? Which dried out?

Answers will vary. Mediums containing vermiculite or peat tend to retain moisture well. Mediums containing high percentages of sand tend to dry out quickly.

4. Which mediums produced the longest roots, and have started to develop root systems?

Answers will vary. Mediums containing a mixture of materials or soil such as loam may allow for better root system development. Once germination is complete roots are needed to feed the plants.

5. Based on what you see, try to design a mix which supports germination, holds moisture, promotes root development, and holds together well enough to support the plant.

Answers will vary. The mix will likely contain a combination of materials. For example, it may contain sand, perlite, or garden soil to improve drainage and promote root development to support the plant, and vermiculite or peat for holding water. Limestone may be added to reduce acidity if peat is used.

6. Could your plant survive in a soilless mix? Is something missing?

Soilless mixes contain no nutrients. Before your plant grows very large, you will see signs of nutrient deficiencies.

Enrichment B

Use a film or video camera to record the growth of a seed that is germinating behind glass. If you do not have a camera, this could still be fun to watch!

Briefly describe the changes you saw in the growth of a seed over a period of time.

Check over the descriptions and, if the students have pictures showing the growth of germinating seeds, encourage them to show their pictures to other agriculture students.

Section 1 Assignment

25

Students are to complete Part A or Part B as their assignment for this section.

Part A

1. Describe the three propagation methods and sources of plant material that you have chosen. (6)

Students should describe propagation from seeds and two other methods of their choice. For full marks they should identify the source of their plant material or seeds.

2. List the materials used for your starting medium. Beside each component, explain the importance of the material for plant propagation. (2)

Answers will vary. Students may use one or more of the following materials as a starting medium. Sand is used to improve drainage, while vermiculite is used to improve water-holding ability. Peat is another material that holds water well – it also provides structure to the mix (holds it together). Perlite is a porous volcanic rock used for good drainage, and to prevent a mix from becoming too compacted.

3. Complete the Plant Journal pages at the back of the Assignment Booklet. You should try to keep this record up-to-date until your plants reach maturity, or until you finish all sections of this module. (9)

These pages are the students' records of their work on the propagation activity. If they are carefully filled out, the Plant Journal pages will be a resource for other parts of this assignment. Marks should be given for neatness, completeness, and effort.

4. Evaluate the success of your propagation methods. (3)

For each method, provide

- the number of seeds or plants started
- the number of plants which survived

Normal seed germination rates should be in the range of 80% or better. All plants should survive unless there is a problem, which is not necessarily bad if the student can figure out why some plants did not germinate.

5. Answer the following questions. (5)
 - a. For each method which was not successful, describe the problems that you encountered.

Students may not have had any problems, but if they did, a description of the problems encountered should be given.

- b. Suggest a reason for the failure, and propose a solution to use in future propagation attempts.

Answers will vary according to the reason for the failure. If a failure is reported, check to see that the student states how such a failure can be avoided next time.

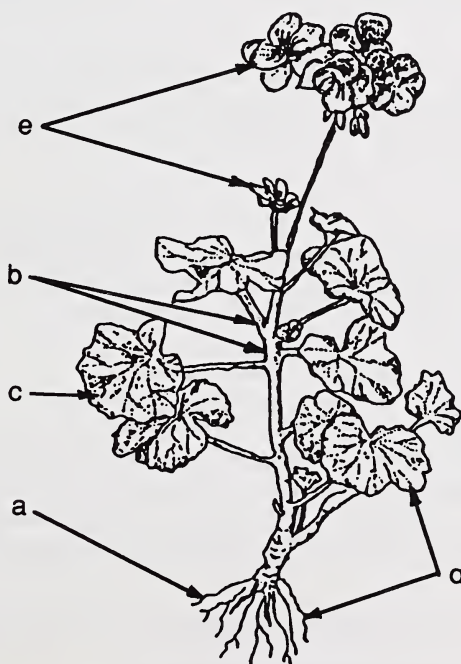
- c. For plants that survived, describe the conditions that made your methods successful.

Success should be attributed to moist soil, proper light (or lack of it), suitable media, and well chosen plants and methods.

Part B

1. Draw a typical plant. Label the parts that do the following things. (5)
 - a. obtain nutrients from the soil
 - b. transport nutrients and water to the leaves or transport food for storage elsewhere
 - c. manufacture food
 - d. store food for later use
 - e. are used for sexual reproduction

Use the following diagram as a guide.



2. a. List four materials that can be used to make a soilless growing medium. (2)

Answers will vary. Sand, vermiculite, peat, and perlite are the best answers.

- b. Give three advantages of soilless mediums for growing indoor plants. (3)

Advantages of soilless mediums for growing indoor plants are that there are no weeds, no insect pests or disease bacteria, and the soilless mediums are easy to work with.

- c. List two advantages of soil as a growing medium for outdoor plants. (2)

Advantages include that soil is abundant, and it serves as a storehouse of nutrients.

3. Describe the main difference between an annual plant and a perennial plant. Give one example of each plant. (2)

Annual plants have short life spans. They complete their life cycles in one growing season. Examples include most plants that prefer to propagate by seed, such as petunias and wheat.

Perennial plants live for many years and have annual periods of growth. Examples include woody plants and any plants that propagate from bulbs. These include lilies, peonies, and roses.

4. List three methods of propagation that you might find in nature. (1.5)

Methods of propagation may include

- *seeds*
- *runners*
- *suckers*
- *bulbs*
- *corms*
- *tubers*

5. Give three methods of propagation that require human hands. (1.5)

Propagation methods that require human hands include

- *propagation from cuttings (leaves, stems)*
- *propagation by pinning, or winding and pinning*
- *air layering*
- *grafting*
- *tissue culturing*

6. What are two advantages of asexual propagation using parts of plants? (2)

Advantages of asexual propagation using parts of plants include the following:

- *It produces plants identical to itself.*
- *It is a fast method of reproduction for some perennial plants.*
- *Some plants do not reproduce pure strains from a seed.*

7. How do humidity and temperature affect plant propagation? (2)

Propagating plants prefer higher humidity and a slightly warmer soil temperature than normal.

8. Choose one of the following three plants. Research and report on two ways that it may be propagated. (2)

- lily
- coleus
- begonia

Descriptions of propagation methods used for all three plants can be found by referring to the Appendix.

- lily – see cuttings, division of a plant or bulb
- coleus – see seeds, leaf cuttings, or stem cuttings
- begonia – see leaf or stem cuttings, divisions

9. Explain why you think sexual reproduction ensures the survival of annual plants in nature from one season to the next. (2)

Reasons include the following:

- *Seeds can withstand difficult climatic conditions.*
- *Some plants produce many seeds – this guarantees that some plants will survive.*
- *Because some seeds are mobile, annual plants can spread to better areas.*

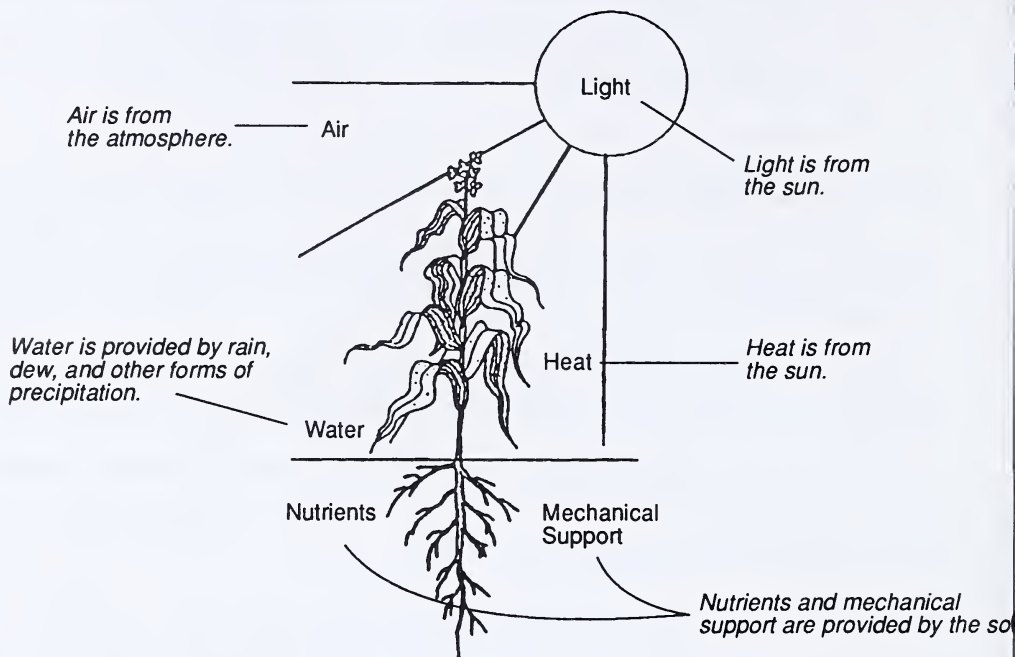
Section 2: Meeting Plant Needs

This section is designed to make students aware of basic plant needs that must be met for the plants to thrive and grow.

Section 2: Activity 1

In this activity students will be presented with some new ideas, and a number of demonstrations to try. They are expected to attempt as many of these demonstrations as they can and share their observations with their learning facilitator.

1. Consider the following corn plant. Beside each of the needs stated on the diagram, state your ideas as to how nature provides the plant with each of these needs.



2. Draw a picture of what you see.

In the first demonstration that students are to try, they are to colour a glass of water with blue food colouring and place a carrot or piece of celery (with green leaves attached) in the water for a day. They are then to cut the carrot or celery lengthwise and across, and examine the channels under a magnifying glass.

The student drawing should show the water-conducting channels as dots in the cross section and as streaks in the long section.

3. Why does this change happen?

Water is taken up by plant cells. The cells inflate with water and become more rigid – this provides structural support for the plant.

4. How can you help a plant that is dry and wilted?

If a plant is dry and wilted, give it water!

¹ Alberta Agriculture for the graphic from *Alberta Soils Course*. Adapted by permission of Home Studies Section, Education Branch, Alberta Agriculture.

5. Name the three ways in which water is used by plants.

Water is used for

- *the transport of nutrients*
- *photosynthesis*
- *the support of plant tissues*

6. How might you prevent plants from drowning?

You can prevent your plants from drowning by allowing the excess water to drain.

7. Can you name the two products of photosynthesis?

Two products of photosynthesis are glucose (sugar) and oxygen.

8. How are these products important to you?

Glucose is stored in plant material as food for plant growth and propagation. People and animals also use plant material as food. Oxygen is released into the air, and is needed for respiration.

9. What has happened to the stalk?

Students should wrap a celery plant in dark paper with the leaves exposed to the light, then set it upright with the base in water for several days to see if any changes happen to the celery.

The stalk should turn white.

10. How does the plant respond?

Students should turn a houseplant, or other plant, so that its leaves face away from the light source, then observe what happens.

The plant leaves turn toward the light. This is called phototropism.

11. Do you see water droplets forming on the inside of the cover over your plant? What causes this?

Students should try making a “greenhouse” for a small plant by cutting off the bottom third from a two-litre clear plastic soft drink bottle, and using the upper two-thirds of the bottle as a dome cover.

The water given off during transpiration raises the humidity inside the greenhouse. As well, the air temperature is usually higher inside the greenhouse than it is outside. Moisture condenses from the moist, warm air as it touches the outer wall.

12. Imagine how a lack of nutrients would affect your plant. Write down your predictions.

A lack of nutrients could affect the plant in many ways, depending on what nutrient or nutrients are missing. Signs may be

- *slow or zero growth*
- *unusual leaf colour – pale or bluish*
- *abnormal growth*
- *spotted and dying leaves*

13. How is a germinating seed different from a growing plant? Where does the food stored in the cotyledon come from?

Germinating seeds depend on food that has been stored in the cotyledon of seeds, while growing plants manufacture their own food. Some of this manufactured food produced by growing plants is stored in the cotyledons.

Did your students remember to fill in the appropriate sections of the Plant Journal in the back of the Assignment Booklet?

Section 2: Activity 2

In this section students will practise plant care techniques using real plants in their home or school. Most of these activities are practical in nature. Students will quickly become confident in their ability to care for plants. It is very difficult to damage a plant with any of the methods presented here.

1. How would you tell the difference between a wilted plant that needs water and a wilted plant that has been overwatered?

Check the soil – if it is not dry, do not add more water.

2. Decide whether the following statements are **True** or **False**. If false, state why the statement is false.
- a. If a plant looks wilted, it always needs more water.

False. The plant may be wilted due to overwatering.

- b. Plants grow best in damp (but not soaked) soil.

True

- c. If soil is up to the top of the pot, watering is easier – you do not have to water so often.

False. *Space is needed at the top of the pot to add enough water to thoroughly soak the soil.*

- d. The best time to water plants is in the morning, soon after the sun begins to shine.

True

- e. Plants prefer to drink fresh cold water.

False. *Room temperature water should be used.*

- f. It is okay to let the top of the soil in the pot become dry.

True

- g. All plants regardless of type, size, and location should be watered at the same time each week.

False. *Plants should be watered when the surface of the soil is dry, and the soil has begun to shrink away from the edge of the pot.*

- h. Plants like rainwater better than water from the tap.

True

- i. If watering from the top, care has to be taken not to wash out small plants.

True

3. Why do many houseplants grow best in moist, warm air?

Most houseplants are imported from tropical climates.

4. Write down the type of lighting preferred by the plants that you have started.

The best lighting for my plants is the following:

Answers will vary, depending on the types of plants selected. Instructions on the seed packages or descriptions in seed catalogues and horticultural guides often supply this type of information. Plants such as asters, chrysanthemums, and goldenrods, which bloom in the spring and fall, or in partial shade during the summer, require less light than plants such as petunias and hollyhocks, which bloom best in the summer.

Did your students remember to add the information from question 4 to the Plant Journal in the back of the Assignment Booklet?

5. Decide whether the following statements are **True** or **False**. If false, state why the statement is false.

- a. Plants use light to give themselves a green suntan.

False. Plants use light energy to manufacture food energy. Chlorophyll, the green substance in leaves, makes this possible.

- b. Plants need light to make food.

True

- c. If plants are exposed to too much light, they will “sunburn” something like you would.

True

- d. All plants require the same amount of light.

False. Some plants will flower only if they receive full sunlight, while other plants will only bloom in shady places.

- e. Plants can live without sunlight.

True (for a short time)

6. The best temperatures for my plants are

Answers will vary. Desert and tropical plants prefer higher temperatures than most plants that are native to this area.

Did your students remember to add the information from question 6 to the Plant Journal in the back of the Assignment Booklet?

7. How much of each nutrient is present in a fertilizer with the number 5-20-10?

Nitrogen: 5%

Phosphorus: 20%

Potassium: 10%

8. A plant that is deficient in certain nutrients will provide you with symptoms of its problem. In the following chart, see if you can determine what mineral the plant is deficient in and what fertilizer could be used to solve each problem based on the symptoms given.

Symptoms	Deficiency (underline one)	Fertilizer (underline one)
The leaves are turning pale green and growth is slow.	<u>Nitrogen</u> Phosphorus Potassium	<u>27-14-0</u> 16-20-0 0-0-50
Some leaves are mottled – curled under. The lower leaves are dropping off.	Nitrogen <u>Phosphorus</u> Potassium	27-14-0 <u>16-20-0</u> 0-0-50
The plants are smallish and fail to flower.	Nitrogen Phosphorus <u>Potassium</u>	27-14-0 16-20-0 <u>0-0-50</u>

Section 2: Activity 3

Students should now check their propagating plants to see if they have developed roots and are ready to be transplanted. Many will have grown seedlings that can be repotted or moved outdoors. Students should follow the guidelines given in the Student Module Booklet about when to transplant.

1. What would be the disadvantage of filling the pot to the top with soil or a rooting medium?

The plant would be difficult to water from the top.

2. What would be the disadvantage of filling the pot only half-full with soil or a rooting medium?

There would be less soil to hold moisture, so the plant would need to be watered more often.

There would also be less soil for the plant to get nutrients from and less soil to anchor the plant firmly.

Students can follow the method outlined in their module booklet to pot their plants. Students should show the repotted plants to the learning facilitator.

Did your students remember to measure the growth of their plants and fill in the appropriate sections of the Plant Journal?

Section 2: Follow-Up Activities

Extra Help

Fill in the blanks in the following paragraphs.

Plants have six basic needs which include *air, heat, light, moisture, nutrients, and support*. All of these needs must be satisfied if the plant is to reach its maximum potential.

Water is used by plants for *transport* of nutrients, *photosynthesis*, and *support* of plant tissues. Most of the water used by a plant is given off during *transpiration*. Plants lose moisture more quickly at higher *temperatures* and lower *humidities*. When a plant loses moisture faster than it can be transported from the roots, the plant begins to *wilt*.

The energy plants use for growth comes from *visible* light. Plants also need energy in the form of *heat*. The amount of this energy determines the rate at which plants grow. You can increase the energy available to plants in special structures called *greenhouses*. The most important use of light energy is for *photosynthesis*. By this process, plants store light energy as food. Because plants differ in the amount of *light* they require, this part of their environment must also be controlled.

Plants obtain nutrients for growth from *air, water, and soil*. When growing plants in a soilless medium, you must supply nutrients in the form of *fertilizer*. The three nutrients most often missing from soils are *nitrogen, phosphorus, and potassium*.

Enrichment

Enrichment A

This is a practical activity in which students can build confidence in working with plants by cleaning and misting plants.

1. Explain why washing a plant's leaves helps it to breathe easier.

Washing removes dust and dirt that clogs the pores (stomates) on plant leaves. This makes it easier for the plant to give off water vapour and take in carbon dioxide from the air.

2. Name three ways in which you can help the air around your plants have more moisture in it than the air in the rest of your home.

You can increase moisture in the air by

- *misting*
- *placing several plants together on a tray bed of gravel and water*
- *placing the plant in an enclosed chamber*

Enrichment B

For this activity students are to examine plants in their homes and evaluate how well each of the plants' needs are being met.

1. What problems were found in your plants?

Answers will vary. The most frequent problems are such things as the following:

Symptoms

- *brown or yellow leaves*
- *white spots on leaves*
- *slow growth*
- *wilting*
- *white crust on the soil*
- *collapse of a plant*
- *mushy dark stem and rotting*
- *tips of leaves turn brown*
- *light green or yellowish leaves and stunted growth*

Possible Causes

- *usually nothing – extreme temperatures are the usual cause*
- *splashing with cold water when watering*
- *normal in winter – possible insufficient light or underfeeding*
- *not enough water, too much heat, poor light, or there may be root damage from overwatering or overfertilizing*
- *salt buildup – cured by removal of salt and watering well with good drainage*
- *sudden environmental change*
- *too much water in cold weather, poor drainage, poor ventilation, fungus infection encouraged by damp, cool conditions*
- *poor humidity, low potash, underwatering*
- *lack of fertilizer, particularly nitrogen*

2. What can you do about this?

Answers will vary. Look for a connection between symptoms and causes. You might need to adjust such things as light, humidity, moisture, and the supply of nutrients to see if this improves the condition of the specific plant.

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Section 2 Assignment

1. a. List six basic plant needs. (3)

Basic plant needs include

- *moisture*
- *air*
- *light*
- *heat*
- *nutrients*
- *structural support*

- b. How would plant growth be affected if one of these needs could not be met? (1)

In order for plants to survive, all plant needs must be met.

- c. How would plant growth be affected if something that the plant needs is in short supply? (1)

If any of the plant requirements are only partly filled, plant growth will be limited.

2. Name the three ways in which plants use water. (3)

Plants use water for

- *the transport of nutrients (transpiration)*
- *photosynthesis*
- *the support of plant tissues*

3. a. What is the importance of light for plant growth? (1)

Light is important for photosynthesis, which manufactures food using energy from sunlight.

- b. Can a plant grow without light? Why or why not? (1)

Plants can survive in darkness for a short time by using respiration, which is the use of energy from food stored in plant cells.

4. How does temperature affect plant growth? (1)

Plants grow more quickly at higher temperatures (up to a point) if all other basic needs are met.

5. a. Why might a plant prefer a transparent plastic or glass cover rather than being exposed to the open air in your home? (1)

Plants might prefer the higher humidity of an enclosed container if their natural surrounding is a warm, tropical climate.

- b. State two other ways in which you can raise the humidity in the air around a houseplant. (2)

You can also raise humidity by misting often with water or placing plants on a tray filled with gravel and water.

6. a. What is the main danger when watering plants? (1)

Overwatering is the main danger when watering plants.

- b. How can this danger be prevented? (1)

Overwatering can be prevented by ensuring that there is adequate drainage.

7. Explain why a seed can grow in a soilless medium without additional nutrients. (1)

Seeds contain their own supplies of nutrients for germination in the cotyledon (a part of the seed).

8. Describe how soil or soilless mediums are important for your plants. (2)

They serve as a reservoir for a supply of moisture and nutrients, and provide plants with support.

9. Plants differ in the amounts of nitrogen, phosphorus, and potassium that they need for various types of growth.

- a. Which of these three nutrients would a foliage (leafy) plant use the most? Why? (1)

Nitrogen – for photosynthesis and leaf production.

- b. Which nutrient would be very important for a flowering plant? Why? (1)

Phosphorus – for the development of fruits and flowers.

- c. Which nutrient is most important to a seedling? Why? (1)

Potassium – for long roots and strong stems.

10. Which type of fertilizer would be best for each of the plants in the previous question? Choose from 40-20-20, 20-40-20, or 20-20-40 fertilizers. (3)

Leafy plant – 40-20-20

Flowering plant – 20-40-20

Seedling – 20-20-40

Now is a good time for students to begin a plant project of their own. They may turn to Section 6: A Plant Project and select a project that interests them. Some guidance and help will be required in the activities related to the project. When they have finished Activities 1 and 2 of Section 6, they should continue with Section 3.

Note: Section 6: A Plant Project is to be done only by those students who have already completed Agriculture: Land and Life Year One. Students who have started directly into the Year Two program without doing the Year One program of Agriculture: Land and Life do not need to do Section 6. They should continue now with Section 3.

Section 3: Creating Controlled Environments

This section is an introduction to the planning and skills required in greenhouse operations. Students will see how environments are controlled for best plant growth.

Section 3: Activity 1

1. What are some of the benefits of growing plants in controlled environments? List as many as you can.

Advantages of growing plants in controlled environments include the following:

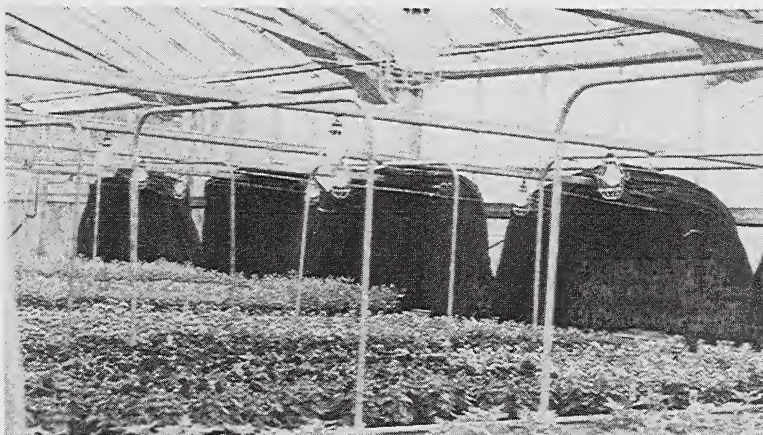
- *You can overcome limits determined by temperature.*
- *An ideal environment for special plants can be created.*
- *Your surroundings can be beautified with indoor plants.*
- *Weed and soil pest problems are avoided.*
- *There is a better and more uniform quality among the plants.*

2. Describe each environment. (You may need to refer to some reference books for additional information.)

- a. **Tropical rain forest:** *This is a very humid environment due to the combined transpiration of so many plants, and frequent rains. Most plants live in the shade created by taller vegetation, because they will not tolerate very hot temperatures or bright sun. The length of night and day is similar because tropical areas are near the equator.*

- b. **Temperate region:** *This region receives a lot of precipitation but temperatures are cooler than they are in tropical areas. There is a full range of seasons (distinct cool and warm or wet and dry seasons) with extremes of temperature and different lengths of day and night. Most plants that live in this region need a cool winter season as a rest period. This is required for budding to occur in the spring – buds are the small green shoots that form on the ends of branches where new growth begins each year.*
- c. **Arid environment:** *This region receives little moisture. The plants are adapted to survive in dry conditions with bright sunlight. Deserts are found at many latitudes, mainly due to the lack of moisture. Cold deserts have a much different vegetation cover than hot deserts.*
3. Plants normally require a burst of reddish light at the beginning and end of the day to help regulate growth. How would you accomplish this in a greenhouse with artificial lights?

You might use a source of red light, such as an incandescent lamp, for a short period in both the morning and the evening.



4. How might the curtains be used in this greenhouse? At what time of year?

The curtains may be used in the summer to shorten the length of the day so that the short-day plants will bloom early.

5. What is the purpose of the incandescent lights? When might they be used?

The incandescent lights may be used in both the morning and the evening to make the plant act as though the days are longer. Long-day plants will be fooled into blooming. You may also bring short-day plants into bloom during the winter months by simply controlling the hours of light that the plants receive.

6. Use the inverse square rule to find the intensity of a light from a high intensity lamp at the following distances:

Distance (metres)	1	2	4
Intensity (lux)	16 000	4000	1000

7. This relationship works well for any “point source” of light that is close to the observer. But what about light from the sun? Would you notice a change in the intensity of sunlight as you walk away from the sun? Why or why not?

A change in the intensity of sunlight would not be noticed due to the great distance between the sun and the earth. Changes in distances on Earth from the sun are very small. Also the rays of light from the sun are essentially parallel for small areas.

8. At which times of the year is a good supply of natural light most critical for plant growth? Explain.

Spring and autumn are the most critical times for lighting. This is when extra light is important to germinate or ripen crops. More than enough light is available in the summer. Natural lighting in winter is inadequate for some plants.

9. In what direction should a greenhouse be positioned to receive the most light at critical times of the year? Why?

An east-west orientation would allow the best roof angle to be exposed to the sun for the greatest length of time.

10. What roof angle would best take advantage of natural light at the critical times of the year?

The best angle of 64° is not practical. A compromise for most greenhouses is a roof angle of 26° when the slopes of both the north and south portions of the roof are considered.

11. How does the tree shown in the previous diagram help manage natural lighting in the greenhouse all year-round?

When natural light is needed in the spring, the tree still has no leaves, but as days get longer and warmer, the tree gets leaves. These leaves help provide summer shade for the greenhouse. In autumn, as the weather gets cooler, the tree loses its leaves and more sunlight is able to reach the greenhouse. Because the tree has no leaves in winter, more light is available to the greenhouse.

12. Each row of the following table will allow you to compare a different type of lighting for a small greenhouse with dimensions of 10 m × 10 m.

- a. Calculate the number of lights you would need, and fill in the last column of the following table. The example just calculated has been entered for you.

By using the calculation method described in the Student Module Booklet students should arrive at the number of lights needed, as given in the following chart.

**TABLE 5-3 COMPARING LIGHTING ALTERNATIVES
FOR SEVERAL DIFFERENT CROPS**

Plants	Light Energy Required (mW/m ²)	Lamp Type	Lamp Size (Watts)	Light Energy Produced (Milliwatts)	Size of the Garden (m ²)	Number of Lights Needed
Tomatoes	20 000	Incandescent	100	6000	100	333
Tomatoes	20 000	Fluorescent	40	7800	100	256
Tomatoes	20 000	Mercury Vapour	400	63 000	100	31
Cucumbers	6000	Fluorescent	40	7800	100	77
Cucumbers	6000	Mercury Vapour	400	63 000	100	10
Strawberries	350	Fluorescent	40	7800	100	4 to 5

- b. Examine the numbers you have calculated. Is it practical to grow crops such as tomatoes or cucumbers by using incandescent or fluorescent lights? Why or why not?

The large number of fixtures required for crops such as tomatoes and cucumbers makes this an impractical choice.

13. Which system might be most practical for

- a. **potted flowers:** *Spaghetti tubes and hand watering are best for potted plants.*
- b. **tropical gardens:** *Misting systems would resemble jungle rainfall.*

- c. **commercial tomato or cucumber plants:** *Sub-irrigation systems are low-maintenance systems designed to handle rooted seedlings.*

14. Circle all results that exceed the noted acceptable limits. Are these mostly major nutrients or trace elements? How can you tell?

GREENHOUSE MEDIA ANALYSIS REPORT		
Completed by: Alberta Agriculture Soils and Animal Nutrition Testing Lab		Submitter: A Greenhouse Gardener Alberta Distance Learning Centre
Sample Number: 25a	Depth: 15 cm	Date: Nov. 4, 1991
Analytical Results (in parts per million of water media extract)		
Type of Analysis	Results	Acceptable Range
pH	5.6	5.5 - 6.9
Elec. Conductivity	4.5	0.8 - 3.0
Nitrogen (as nitrate) – N	522	35 - 180
Chlorine – Cl	175	0 - 30
Sulphur (as sulphate) – S	153	30 - 60
Phosphorus – P	64	5 - 50
Potassium – K	454	35 - 500
Sodium – Na	32	0 - 30
Calcium – Ca	420	60 - 400
Magnesium – Mg	139	30 - 200
Zinc – Zn	0.75	0.3 - 3.0
Copper – Cu	0.02	0.001 - 0.5
Manganese – Mn	0.5	0.05 - 0.5
Iron – Fe	0.62	0.3 - 5.0
Boron – B	0.34	0.05 - 0.5
Molybdenum – Mo	0.05	0.01 - 0.1

The circled results indicate mostly major nutrients. Nitrogen, sulphur, potassium, and calcium are all macronutrients which plants need in large quantities. Most of the micronutrients, or trace elements, are within the acceptable range.

15. What is the most likely explanation of high N, P, K, and S values? How might you get these nutrients back to acceptable levels?

Overfertilization is the most probable cause. If it is toxic, the soil can be flushed with water to leach the substances out of it. Otherwise, suspend fertilization until the levels are down.

16. Is there a problem of too much salt (NaCl) in the soil? Explain.

The sodium (Na) level is not yet a serious problem. However, the chlorine (Cl) level is very high. This suggests another source, such as chlorine in the water.

17. How is heat important to growing plants?

The amount of heat determines the rate of growth.

18. The barrel will be more efficient if it is painted black. Why is this true?

The colour black absorbs more heat than other colours, and this will cause the water to warm up more than it otherwise would. The heat will also be radiated into the surroundings more readily by the black barrel.

19. How does too much heat affect plants?

Too much heat (above about 50°C) kills plants – they cannot usually be saved.

20. Energy conservation is part of an efficient operation. List five ways to cool a greenhouse, starting with those that use the most energy, and finishing with those that use the least energy.

Cooling fans

Evaporation cooling systems

Shades and screens

Roof and side vents

Plant transpiration

21. What do you think ethylene gas will do to green bananas?

Ethylene gas will cause the bananas to quickly ripen.

Students can observe the effect that ripened fruit has on green fruit by trying an experiment with green bananas. They can divide a bunch of green bananas into two groups, and place the bananas into separate bags. A ripe banana or other ripe fruit is to be added to one of the bags. Students should then observe the two groups of bananas for several days.

22. Which group ripens more quickly?

The bunch of green bananas with the ripe fruit included will ripen more quickly due to the ethylene that is given off by the ripe fruit.

23. By now you realize that controlling plant environments is a major concern and translates into full-time jobs for many people. Why should this be, when outdoor plants seem to generally get along without human help? Discuss at least three reasons.

Controlled environments allow people to

- *grow crops in a difficult climate*
- *create an ideal environment for special plants*
- *beautify their surroundings with indoor plants*
- *develop higher production levels by controlling the available nutrients*
- *avoid weed and soil pest problems*
- *obtain a better and more uniform quality among the produce*

Section 3: Activity 2

A growth chamber is a structure that provides a unique microenvironment in which to grow plants. The construction of a model growth chamber will give students a practical problem in which to apply some of the concepts from the previous activity.

1. In previous activities you have looked at the environmental factors that could be controlled within a growth chamber. What are these factors?

Factors that can be controlled in a growth chamber include the following:

- *temperature*
- *lighting*
- *humidity and moisture*
- *nutrient application*
- *carbon-dioxide levels*
- *the soil type and condition*
- *pests and diseases*

Students are to do Part A or Part B, and then complete Part C.

Part A

A growth chamber can give your plants a long summer of growth. Because plants get an early start in the spring, you can harvest crops or flowers sooner, or raise varieties that cannot normally be grown in an unprotected garden.

You will require materials, space, and help to set up your structure; however, you should have little trouble finding someone to help, and to share the results of your efforts.

Note: Instructions for building several simple outdoor structures are included with Section 6: A Plant Project. See Project H.

Ask to see your student's growth chamber, or at least a picture of it. Discuss what plants will be grown in the chamber.

Part B

If you are unable to build an outdoor structure, construct a working model of a growth chamber that is made of your own design.

You may build your structure out of materials such as wood, wire, plastic, or sandwich wrap.

In your model you may plant seedlings, rooted cuttings, or seeds in potting soil or a soilless medium. Suitable plants would be radishes or butter lettuce, as these plants grow quickly. If you prefer a vine plant, and are prepared to wait a bit longer, try to grow pickling cucumbers.

Ask to see your student's growth chamber. Discuss what plants will be grown in the chamber.

Part C

1. How does your structure control each of the following for your plants?

a. Light

– natural

Your growth chamber can be placed in the best location to receive the outdoor sunlight. If it is indoors, the chamber can be placed in the best position in relation to the windows.

– artificial

You can control the placement of lights in relation to the plants, the duration of lighting, and the types of lights used.

b. Temperature

A cover for the growth chamber will control soil temperature by raising the humidity and reducing evaporation.

c. Moisture

The frequency of watering, an adequate amount of drainage, and a cover to control humidity can be initiated in the controlled environment of a growth chamber.

2. Which plants did you select? Why did you select them for this particular microenvironment?

Answers will vary. Selection is very important for indoor environments containing many types of plants. The plants should be compatible, and they must prefer similar growing conditions.

If several plants are to be grown, they should be plants that prefer the same environment.

Section 3: Follow-Up Activities

Extra Help

1. How would you control the environment to remove the following obstacles to plant growth?

a. cold temperatures

Use a protective cover and add heat to keep the plants warm enough to promote growth.

b. a short growing season

Use artificial lights so there is sufficient light for plants to grow properly.

c. soil that has a nutrient deficiency

You can add fertilizer to soils to make them more suitable for plant growth.

d. dry conditions

You can water the plants more and increase the humidity in the controlled environment.

2. Once the major problems have been solved, growers can really make plants work! Use the information in this module to explain how you would

a. get a fruit to ripen

To get a fruit to ripen faster you could place it in an environment with ethylene gas.

- b. “train” a plant to grow the way you want it to

A plant can be made to grow the way you want it to if you prune unwanted branches.

- c. make plants bloom in winter

If you manipulate the length of the day, plants can be made to bloom in winter.

- d. grow a seedless cucumber

If you spray a plant with hormones to make it react as if it has been pollinated, the plant will produce seedless fruit.

Enrichment

Enrichment A

Visit a local greenhouse or plant conservatory. While visiting, ask questions about such things as temperature controls, humidity, lighting, carbon dioxide levels, pest controls, and the soil condition. Write a short report on how people at the greenhouse or conservatory control the environment.

Answers will vary. Check to see that the reports include answers to such things as how temperature, humidity, carbon dioxide levels, pests, and soil conditions are controlled within a greenhouse or conservatory environment.

Enrichment B

Read the Appendix case study about *The Central Alberta Florist: Growing Division – 1987*. Identify and briefly describe all of the systems that control environments in this type of greenhouse operation. Use the following lines for your response to the Enrichment of your choice.

Environments are controlled in this type of greenhouse operation by the following:

- *Propagation greenhouses – Some greenhouses are used only for seeding and the propagation of plants requiring the same growing conditions.*
- *Watering systems – In this case the automatic watering system includes spaghetti tubes with fertilizer being injected into the water in two out of every three watering cycles.*
- *Lighting systems – Lighting is controlled differently in each greenhouse, depending on the types of plants being grown.*
- *Backup systems – Emergency diesel electric generators are used in case of power failure.*
- *Heating systems – Steam heated by natural gas boilers is used.*

- *Cooling systems – Cooling is accomplished by large roof fans, roof vents, and side walls that swing open.*

The greenhouses are constructed in such a way as to help control various environmental factors and procedures are also in place to control pests. For more detailed descriptions of the systems used to control environments, see the case study included in the Appendix of the Student Module Booklet.

Did your students remember to measure the growth of their plants and fill in the appropriate sections of the Plant Journal in the Assignment Booklet?

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Section 3 Assignment

1. a. What types of plants do you plan to grow? (1)

Answers will vary.

- b. Do you need a large or small area? If you select more than one type of plant, remember that the plants should prefer similar levels of light, heat, and moisture. (1)

Answers will vary depending upon the types of plants chosen and the purpose for which the plants are grown.

2. Greenhouses are designed to overcome a variety of hostile environmental factors, such as

- a short growing season
- cold temperatures
- a lack of air

List the environmental conditions which must be controlled in the greenhouse that you are designing. (2)

Answers may vary depending on the purpose of the greenhouse and for what months of the year it will be operated. Award marks for environmental conditions listed that are consistent with the purpose for which the student is designing the greenhouse.

3. Decide what materials you want for the walls and roof. Draw a side or front view of your greenhouse to show how these materials will be used. (3)

Note: For further ideas see Section 5: Activity 2 in the Student Module Booklet.

Answers may vary. Award marks for originality, neatness, and the appropriate use of materials. Materials may include such items as wood and glass structures for backyard multi-purpose greenhouses, to computer-controlled domes made of aluminum frames and double-walled polyethylene sheeting supported by compressed air between the layers.

4. a. Choose a size for your structure. Draw a floor plan to show the size and shape of your greenhouse. (2)

Answers may vary. Award marks for originality and neatness.

- b. Illustrate on the floor plan where the plants will be situated. Use rectangles or squares as symbols for tables. (1)

Answers may vary. Award marks for originality and neatness.

5. • What type of lights will you need? How many light fixtures will you need? Where will they be located? Use tables 5-1, 5-2, and 5-3 in the Section 3 Module Booklet to calculate the number of lights. (2)
- Use a symbol (•) for the light fixtures. Distribute them evenly on the floor plan in question 4. (1)

Answers will vary. Measure the size of the greenhouse and use Table 5-3 to calculate what number of lights should be in the greenhouse. Note that incandescent or fluorescent lights are only appropriate for small greenhouses, and not for high energy users such as tomatoes or cucumbers.

6. Describe how you will heat and/or cool your greenhouse. Remember that daytime heat can be stored for later use. The less heat you lose, the less heat must be added. (2)

Answers will vary. Give full marks for innovative energy conscious choices. Heating methods may include passive and active solar heating, hot water central heating systems, forced air furnaces, or electric radiant heaters. Cooling devices may include movable roof vents, fans, shutters or blinds, or evaporation cooling systems.

7. Write a description of the watering system in your greenhouse. (2)

Answers will vary. Look for a logical design.

- *potted flowers – spaghetti tubes and hand watering are best for potted plants*
- *tropical gardens – misting systems would model jungle rainfall*
- *commercial tomato or cucumber plants – subirrigation systems are low-maintenance systems designed to handle rooted seedlings*

8. Write a description of any special procedures needed to monitor and control each of the following items. (8)
- humidity
 - carbon dioxide in the atmosphere
 - fertilizer application
 - plant growth

Answers will vary for all parts of question 8. Award two marks for each new idea.

Section 4: Controlling Pests and Diseases

Section 4: Activity 1

In this activity students will use real plants as much as possible to reinforce their knowledge of plant diseases. Most houseplants will be in excellent health! Outdoor plants, on the other hand, may show specific problems, particularly when they are brought indoors where predators are not present to keep pest populations in check.

If students plan to examine outdoor plants, these outdoor plants should not be brought indoors near plants where they may start an unwanted infestation.

- Is there a plant in your home that does not look well? Answer these questions for your plant.
 - Is this plant new to your home?
 - Has your potting soil been sterilized?
 - Have you been watering correctly?
 - Have you applied nutrients properly?
 - Is the lighting correct for your plant?

These questions will help the student identify the problem or problems that the plant may have.

- Does your plant show any of these symptoms?

The student should look for the symptoms listed in the module booklet as the plant is examined – these symptoms will help to identify the problem that the plant may have.

3. What is the purpose for isolating a plant if you suspect that it may be diseased?

Isolating a plant will prevent diseases or pests from spreading to healthy plants.

4. What is the best thing to do with a plant that does not respond to treatment?

Discard the plant in a place away from other living plants if it does not respond to treatment.

5. How would you treat the following symptoms of disease?

- a. droopy, blackened, and mushy leaves and stems

Moving the plant to dry conditions may help, but you may have to restart the plant from healthy cuttings.

- b. a whitish, powdery coating on the leaves of your terrarium plants

This sounds like a mould that enjoys moist conditions. If your plant can tolerate a drier environment, you may try to save it by lowering the humidity and pruning the infected leaves. Dust with a fungicide powder. The problem will probably reappear whenever the air becomes too moist.

- c. ringlike spots appear on leaves

This may be a pest problem or a bacterial-viral disease. It usually affects only certain plants. If it is serious, cut, burn, or otherwise dispose of the crop. Plant a different type of crop in this area.

- d. rooted cuttings collapse and die

You should pasteurize the soil or starting media, wash and disinfect the tray, and start again.

- e. black streaks are found on the trunk of a favourite apple tree

You should cut down and burn the tree. Keep it away from other trees.

6. Check your plant for any of the following signs.

As the plant is examined, the student should look for the symptoms listed in the module booklet. These symptoms will help to identify the problem that the plant may have.

7. Name the main difference in appearance between one leaf that is attacked by an insect, and another leaf that is suffering from neglect.

Signs of neglect will usually be related to an environmental problem that needs to be identified. Insects usually leave a visible sign of specific damage – look for tiny pinholes in the leaf, and for pests or eggs on the underside of leaves.

8. In Section 2 you learned about soil sterilization. Why is this done?

Sterilization kills insect pests and their eggs, plus bacteria and weed seeds.

9. How might washing your plants prevent diseases and insect pests? Suggest two reasons.

Washing will produce a healthier plant that is more able to resist diseases and pest attacks.

Washing will also remove pests and their eggs and clean up the mess that they leave – this is a cultural control but not a cure.

Insects are frequently brought into an insect-free house by innocently bringing in an infected plant. Any new plant being brought into the house from a store, garden, or neighbour, should be kept by itself (in isolation) for a week or so to determine if it is a carrier of any insects. If this plant is infected, there will be only one plant to treat or throw out.

Section 4: Activity 2

1. Name the three types of pest controls. Try to give one example of each method.

The three types of pest controls are

- *cultural: tillage, washing, handpicking, pruning*
- *chemical: insecticides, herbicides*
- *biological: predators, parasites, bacterial diseases*

The videotape *Pest Wars* contains several accounts of how farmers are fighting the battle against pests. This is a good presentation of pest controls for field crops, but similar methods are also employed in greenhouses and gardens.

2. Describe one situation where each of these methods of pest control might be used.

tillage: *hoeing a garden*

washing: *removing insect pests from a houseplant*

crop rotation: *used in fields and gardens*

weeding: *removing weeds by hand in a garden*

pruning: *cutting diseased branches from a tree*

3. Give three reasons why the safe use of chemical pesticides is important.

The safe use of chemical pesticides is important in

- *protecting personal health*
- *preventing the pollution of the environment or the contamination of crops*
- *preventing unwanted damage to beneficial plants and wildlife*

4. Why should you not use chemicals to kill aphids when large numbers of ladybugs are present?

Ladybugs are an effective type of biological pest control.

5. What is the disadvantage of using sprays in a home?

Sprays spread around the house as tiny airborne particles.

6. What is the safest method of getting rid of any insects that invade your home or greenhouse?

Physical controls such as washing, handpicking, and pruning are the safest methods.

7. What is a method used in commercial greenhouses that is not feasible for use in the home?

Biological controls are effective where there are large numbers of plants.

8. How would you rid a houseplant of spider mites?

You could wash the plant with ordinary or insecticidal soap to start, then take the plant outside and spray it with an appropriate insecticide.

9. How might you control aphids on an ornamental bush or small fruit tree? Explain the reasons for your choice.

You could prune severely affected branches, then wash by hosing with a strong spray of water. Finish off by spraying with an appropriate insecticide.

10. How would you control mealybugs on a houseplant?

Cultural controls such as handpicking, pruning, and washing would control the pest but not necessarily eliminate it. A dusting with chemical powder following a wash could prove effective in controlling mealybugs.

11. How would you get rid of caterpillars in the trees of a park or farm shelterbelt? Explain the reasons for your choice.

*The usual approach is to spray chemical insecticide. An alternative solution would be to spray the bacteria *Bacillus thuringiensis* – this would be a safer choice for a populated area.*

12. Which control would you use in a greenhouse growing long English cucumbers? Why?

*Chemical sprays are not advisable for edible crops. The biological control **Encarsia formosa**, which attacks both larvae and adult flies, could be used.*

13. What is a sure way to prevent an infestation of soil pests?

Sterilizing soil or using a soilless mix is the best way to prevent an infestation of soil pests in houseplants.

14. Have you ever experienced a problem with weeds? How did you solve the problem?

Answers will vary. Most students will identify cultural solutions.

15. Name the best method for controlling weeds in each of the following situations:

- a. a small vegetable garden

Handpicking or hoeing the weeds would be the best methods.

- b. a large greenhouse

Using soilless media, turning soil between crops, or using chemical herbicides would help control weeds.

- c. a field that has been left fallow (no crop planted)

Tillage is an effective control for weeds in a field.

- d. a field that has just been planted

Herbicides can be used effectively to control weeds in a newly-planted field.

- e. a lawn

Herbicides will help control dandelions or other lawn weeds.

- f. a flower bed populated by ornamental shrubs

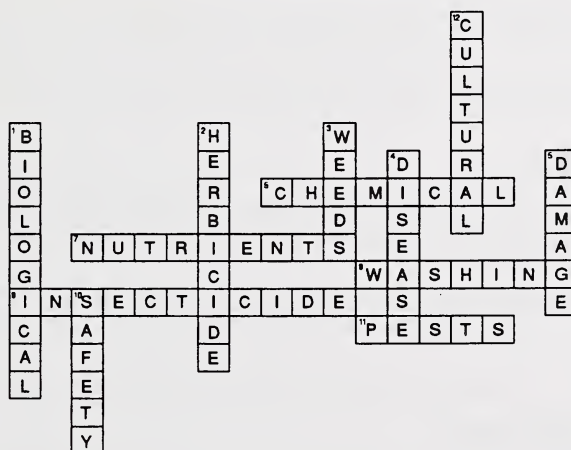
Handpicking or hoeing the weeds are the best methods for controlling weeds.

Remind students to keep their Plant Journal records up-to-date.

Section 4: Follow-Up Activities

Extra Help

Correction: Have students add two spaces to the top of 2 Down in the Crossword Puzzle. The correct answer to “This chemical is used to kill weeds” is **HERBICIDE**, but only seven spaces are provided in the Student Module Booklet instead of nine. Supply students with this answer.



Across Clues

6. This pest control works quickly.
7. Weeds compete with crops for these.
8. Use this to keep houseplants healthy.
9. This chemical kills insects.
11. This is the topic of this section.

Down Clues

1. This method of pest control employs other living things.
2. This chemical is used to kill weeds.
3. This pest competes with plants for space.
4. This is a good reason to quarantine (isolate) your plant.
5. Insect pests do this to crops.
10. This is your greatest concern when using chemical pesticides.
12. This means of controlling pests removes them or changes their surroundings.

Enrichment

Enrichment A

Do you have a particular pest problem where you live? Perhaps a neighbour or friend has problems with pests. Read material about a type of pest to discover its life cycle and habits. Then plan a strategy to get rid of it.

If you are unsure what to do in regard to insects or plant disease, contact your nearest office of Alberta Agriculture. People in the office can usually provide you with expertise and information, including many free publications and pamphlets.

Write a short summary about the pest that you researched.

Check to see if the students have a feasible plan to eliminate the insects. Answers will vary.

Enrichment B

With the aid of *Weeds of Alberta* and *Backyard Pest Management*, collect and identify at least ten insects or weeds.

Discuss the collection of weeds or insects. Check to see if the student has a good variety in either case.

15

Section 4 Assignment

1. Describe two ways in which pests and diseases could have entered your greenhouse environment. (2)

Pests and diseases could have entered your greenhouse environment through

- *airborne bacteria or spores*
- *contaminated water*
- *contaminated soil*

2. a. Name the three types of controls used for insect pests, and provide an example of each type. (3)

Three types of controls used for insect pests are

- *cultural: tillage, washing, handpicking, pruning*
- *chemical: herbicides or pesticides*
- *biological: predators, parasites, bacterial*

- b. As a greenhouse operator, which types of controls for insect pests would you most likely use? (1)

It may be best to use all three types of controls in an integrated pest management system.

3. Name two different ways in which an insect pest can consume chemical pesticides? (1)

Two ways in which insect pests can consume chemical pesticides are the following:

- *systemic – by sucking plant juices containing insecticide*
- *nonsystemic – by eating leaves which are coated with insecticide*

4. Identify the problem in each of the following situations as environmental, a plant disease, or an insect pest. Suggest a solution or treatment in each case. (5)

- a. Your plant is wilted and its leaf tips are turning brown.

Environmental – Check the soil. If it is dry, your plant is probably short of water.

- b. The leaves of your plant have started to develop spots that seem to grow each day.

Plant disease – This could be a bacterial or a viral disease. Isolate the plant and prune affected leaves. Discard the plant if the problem becomes worse.

- c. Your plant looks limp. The leaves have unsightly black deposits.

Insect pest – The black deposits are mould which grows on honeydew that is left by sucking insect pests. Check under leaves. When you have identified the pest wash the plant with insecticidal soap or spray the plant outdoors.

- d. The young seedlings that you have just propagated have fallen flat and appear lifeless.

Plant disease – This sounds like dampening-off disease, which attacks plant stems at the soil surface. Clean and disinfect your propagation equipment and start again using a sterile soilless mix. Be sure to water from the bottom.

- e. The leaves of your plant are yellowish, and the plant growth is slow.

Environmental – This sounds like a shortage of nitrogen fertilizer.

5. Name an appropriate method for controlling weeds in each of the following. (3)

- a. **a field** – *tillage, soil sterilization, preemergent, or selective (postemergent) herbicides*
- b. **a greenhouse** – *soil steaming, soil drenching (soil sterilization)*
- c. **a front lawn** – *pulling weeds, contact herbicides, selective (broad leaf) herbicides*

Section 5: Frontiers of Production

In this section students explore where greenhouse technology is going and how it may affect the future.

Section 5: Activity 1

1. Write down all of the reasons that you can think of why people might want to grow plants without soil. There are more reasons than you might guess!

People may want to grow plants without soil because of the following:

- *The soil in your area is poor or not available.*
- *You want to obtain higher production levels by controlling available nutrients.*
- *You want to avoid weed and soil pest problems.*
- *You want to eliminate the need for soil reworking and pasteurization, which cause production delays.*
- *You want better quality and uniform produce.*
- *You enjoy the challenge of growing plants without soil.*
- *You are looking for a hobby.*

2. What two plant needs are provided for by the soil?

Soil, which is a storehouse of nutrients, also acts as an anchor for the plant.

3. How does a hydroponic plant have these needs met?

People monitor nutrient levels and regulate the supply of nutrients. Plants are anchored in the soilless medium, or are sometimes tied up with string or other material.

4. Describe how you, or someone else, might use hydroponic systems to produce food in a difficult environment.

Answers will vary. Look for imaginative responses.

Section 5: Activity 2

1. How many possible sources of wasted heat can you identify? List as many as you can.

Some sources of wasted heat are as follows:

- *lumber and pulp mills*
- *power plants*
- *gas plants*
- *solar heat*
- *geothermal (underground) sources*

2. List three types of greenhouse crops grown in Alberta. Try to identify two varieties of each crop. Write the crop names in the three blanks on the top answer lines. Fill in the varieties below each crop name.

Answers will vary. Common types include the following:

<i>Cucumbers</i>	<i>Tomatoes</i>	<i>Flowers</i>
<i>long English</i>	<i>brick red</i>	<i>roses</i>
<i>field</i>	<i>Roma</i>	<i>carinations</i>
<i>pickling</i>	<i>cherry</i>	<i>lilies</i>

3. Read the description of the greenhouse operated by Joe and Helen Doef. Make a list of the new methods and technology that they are using to make their greenhouse successful.

New methods used by the Doef's include

- *double-walled polyethylene construction*
- *soiless growing media*
- *hydroponic systems*
- *computerized environmental controls*
- *biological pest controls*

Section 5: Activity 3

1. Write **FACT** or **FICTION** below each of the following:

- a. DNA is found in all living cells.

FACT

- b. Genes are sections of code on a DNA molecule that help living cells reproduce.

FACT

- c. Crossbreeding two different types of cucumbers will produce a plant with characteristics of both parent types.

FACT

- d. Scientists splice sections of DNA from different creatures to create monsters.

FICTION

- e. Scientists can splice sections of DNA in living plant cells to create plants with combined traits.

FACT

- f. Mutations are always monsters.

FICTION

2. Examine the list of six agricultural advances. Suggest five ways in which these new plants will help future farmers be more successful.

Ways in which new plants will help farmers be more successful include the following:

- *New products add variety and give people healthier alternatives.*
- *New products form the basis for new industries and successful farming.*
- *New crops can increase the food supply.*
- *Resistance to pests or pesticides can reduce crop losses.*
- *The new products are hopefully kinder to the environment than are current crops.*

Section 5: Follow-Up Activities

Extra Help

Fill in the blanks as a review of this section.

Controlled *environment* agriculture is a new concept where crops are grown under controlled conditions. A modern greenhouse is usually a structure made of *aluminum* and *polyethylene*. It uses *hydroponic* methods and *soilless* growing mediums. Special equipment is used to monitor and control *lighting*, *temperature*, and *nutrients*.

One of the problems to be overcome when operating a greenhouse in a northern climate is the cost of *energy*. One solution is to use *waste* heat produced by industry. *Solar* heat is available to everyone.

Scientists have studied the ways that living things pass on *traits* from one generation to another. These scientists have found a substance in the *cells* of all living things that controls cell reproduction. This is a complex chained molecule called *DNA*. This molecule is like a blueprint, or a set of instructions, to produce the cells that form a living organism. Scientists who work to change this blueprint are called *genetic engineers*. They often use a special method of plant propagation called *tissue culturing*. Plant breeders can *select* plants with desirable traits, and cultivate them to create new plant varieties which meet special needs.

Enrichment

Enrichment A

What have you learned about the Epcot Center?

Check to see what information the student found out about the Epcot Center.

*If the student is unable to obtain the book called **The Future World of Agriculture** in the local library, it may be ordered from other libraries, or it can be ordered from bookstores.*

Ask for the following:

*Murphy, Wendy. **The Future World of Agriculture**. An Epcot Center Book, Walt Disney World, Publisher Franklin Watts. New York/Toronto, 1984.*

*If you are unable to locate this resource, try to obtain periodicals that deal with new methods of hydroponic gardening, such as **The Growing Edge**, or **The 21st Century Gardener**.*

Enrichment B

Let your imagination run wild! Brainstorm with adults, brothers, sisters, or other students to get ideas for the perfect structure in a hostile environment such as Antarctica, the moon, or a space station. Make a drawing of your structure, and label important features.

Drawings and labels will vary. Check for imaginative, creative features on the drawing, but at the same time, ensure that ideas are appropriate for the hostile environments selected by the students.

Check to see that your students are maintaining an up-to-date record of their growing plants in their Plant Journals.

10

Section 5 Assignment

Write an essay of 250 words (or more) on one of the following topics.

- Which is better for Alberta's economy: producing or importing vegetables?
- How will improvements in greenhouse technology affect the world?
- Is there a particular career in greenhouse operations that interests you?
- Describe the areas of the world that you are familiar with where greenhouse technology might be most useful.

Answers will vary for each of the four potential questions in the Section 5 Assignment.

- *Look for the following points in favour of producing over importing vegetables:*
 - *the creation of employment in greenhouses and related industries*
 - *better prices and a stable supply of produce*
 - *the chance to become experienced in plant technologies*
 - *creates products for export*
 - *fresher produce all year*
- *Greenhouse technology improvements will affect the world in the following ways:*
 - *the creation of employment in greenhouses and related industries*
 - *better prices and a stable supply of produce*
 - *an improved food supply*
 - *fresher produce all year*
 - *more and better plants*
 - *lower energy costs*
 - *fewer demands on the environment*
- *Answers about careers will vary. Students may select a career in food production, plant or crop research, plant biotechnology, gardening, or landscaping.*
- *Areas of the world where greenhouse technology might be most useful include the following:*
 - *Northern climates, where obstacles will be cold climates or short growing seasons.*
 - *An area of the world that is suffering from a food shortage. Students should describe how people in such an area would benefit from greenhouse technology.*

A final grading for Module 2 can be determined at this point. The assignments for Section 6: A Plant Project are evaluated as part of Module 4.

Section 6: A Plant Project

Student projects are included in the Agriculture: Land and Life Year Two course to allow students to pursue personal interests. A choice of plant projects have been included at this time to allow time for hands-on experience with plants. A library research project (Project D) is suggested for those students who prefer this method of completing the course requirements, instead of growing plants.

Note: Section 6: A Plant Project is to be done only by those students who have previously completed Agriculture: Land and Life Year One. If this course is the student's first enrolment in the Agriculture: Land and Life program, then the plant project is to be omitted – Part A: What Is Agriculture? in Module 4 will need to be done instead.

The type of project students select will vary. As a result not all of the activities in Section 6 are critical to the completion of any one individual project. The activities in Section 6 are included to assist students with the planning and completing of assignments regarding the plant project in the Module 4 Assignment Booklet.

Section 6: Activity 1

Students should use this activity to select a project and set reasonable objectives. This was probably done when students completed Section 2 of this module.

1. What kind of plant project would you like to do? Write down your thoughts.

Answers to this question will vary. If students are not able to raise a plant, they should do a crop research project.

2. Write down your choice.

Answers will vary. Student choices will include one of the following.

Project A: Collect and Test a Variety of Seeds

Project B: See the Effects of Fertilization

Project C: How Does Lighting Affect Plants?

Project D: Crop Research

Project E: Grow a Plant with Hydroponics

Project F: Growing Crops and Weeds

Project G: Create a Terrarium for Plants

Project H: Create an Outdoor Growth Chamber

3. Write down a list of your materials.

Answers will vary. Compare student lists with the project description. Each project will need special equipment and materials. A student's ability to do the project may depend on the availability of these materials – if necessary, try to suggest alternate materials. Don't forget materials for propagating and transplanting.

Students should check and discuss their plans with their learning facilitator. Please ensure that their choice of project and goals can be achieved.

Students should now complete Assignment 1 in Part B: Project 1 – A Plant Project, which is located in the Module 4 Assignment Booklet.

Note: The project assignments are included as part of Module 4 to allow students time to work on their projects while continuing to work on other modules.

5

Part B: Project 1: Assignment 1

1. Which plant project do you plan to do? Describe your project. (2)

This should be a summary of the project.

2. State your goals. What do you hope to achieve with this project? (3)

Answers will vary.

Section 6: Activity 2

Several sources of information are suggested to help students with this part of their project.

If students are growing plants, they may have to look for more information in the library, refer to the unit on growing plants in the textbooks which accompany the Science 8 course, or talk to a knowledgeable person.

If students plan to do a Crop Research Project, they should make a rough outline of the topics to cover, then look for reference materials, such as home gardening books and encyclopedias, to supply information on these topics.

Written reports must cover the following topics:

- a description of the origin and history of the plant's cultivation
- the environment required for growth
- where the plant is grown
- how the plant is grown
- how it is sold
- how the plant is processed
- what foods or other products are made from the plant

Another source for information is the Information Services Division of Alberta Agriculture. This government department has many free publications on the growing of houseplants, vegetables, and field crops. A complete list of publications is available from your District Agriculturalist or from the following:

Information Services Division
Alberta Agriculture
7000-113 Street
Edmonton, Alberta
T5T 2S7

Students should now complete Assignment 2 in Part B: Project 1, which is located in the Module 4 Assignment Booklet.

5

Part B: Project 1: Assignment 2

1. List all reference books that you plan to use on this project. Add the author, title, publisher, and date of publication. Follow with a one-line description of the content.

Answers will vary. Check for complete descriptions.

2. List any people or clubs that might provide you with help and information.

Answers will vary. Check for complete descriptions.

3. Add new sources of information to your list as you find them.

Answers will vary. Check for complete descriptions of resources.

Section 6: Activity 3

This activity is included to help students plan steps to achieve their objectives. Some sample tasks are mentioned in the Student Module Booklet.

1. Make a list of all of the tasks that need to be completed as part of your project. Then number each task in the order that it must be done.

Answers will vary from project to project. This list will help students prepare a flow chart in the Assignment Booklet.

2. Use a symbol (*) to indicate which tasks in the previous list will require you to gather further information.

This will help students identify further tasks.

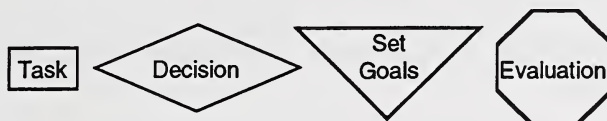
Students should now complete Assignment 3 in Part B: Project 1, which is located in the Module 4 Assignment Booklet. They can use the list of tasks completed for this activity to help them complete a flow chart in Assignment 3.

Part B: Project 1: Assignment 3

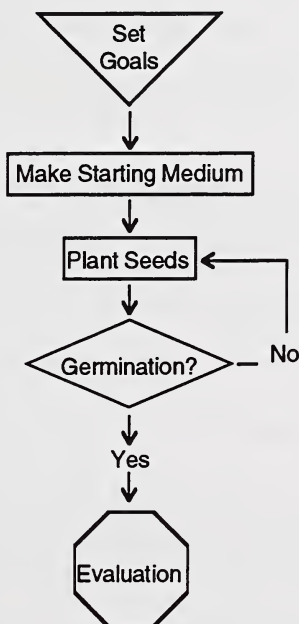
Students are to do either question 1 or question 2. Question 1 is to be done by students who are growing plants. Question 2 is to be done by students who are doing a Crop Research Project.

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1. a. If you are growing plants, make a flow chart that shows all the tasks you must do in order to complete your project. Use words or the following symbols in your chart: (10)



The following is an example of a simple flowchart.



Answers will vary. Check for a logical sequence of operations. Students may use the example of the simple flow chart as a guide.

- b. Describe the environmental factors that you will control in order to grow your plants. If you have more than one group of plants, describe the conditions for each group. (5)

Answers will vary with the choices of plants and the nature of the central activity.

5

2. Prepare an outline for your report on a special crop, or a plant that is grown in a controlled environment. See the description of the Crop Research Project in the Student Module Booklet for a list of information that must be included in your report. (5)

The outline should mention the topics that will be reported on later. This includes the origin and history of the crop (or plant), where and how it is grown, the environment needed for its growth, and how the crop is processed to make other products.

Section 6: Activity 4

This activity is related to the main assignment for this project. The assignment will be one of two different tasks depending on the nature of the project. This activity supplies guidelines for

- record keeping and growing plants in a controlled situation
- preparing a written report on a particular plant

A journal can be a tool to help students organize regular visits to measure or monitor the plants. As part of this project, students are to set up and keep a Plant Journal in the Module 4 Assignment Booklet. When making a visit students should record

- the date
- what was done (such as watering or fertilizing)
- measurements of plant heights
- observations about changes in plant growth (first shoot, first leaf, first bud)

Students should now complete Assignment 4 in Part B: Project 1, which is located in the Module 4 Assignment Booklet.

Part B: Project 1: Assignment 4

Students are to do either question 1 or question 2. Question 1 is for students who are growing plants. Question 2 is for students who are doing a Crop Research Project.

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1. a. Keep a record of plant growth and growing conditions for your plants. Set up a journal on the response pages. Use a separate page for each type of plant or growing condition. You may use written descriptions to record the information in your journal, or the Plant Journal in Module 2 as an example of how to set up your pages. (15)

Review the student records for a full description of growing conditions, and at least ten entries where students made some sorts of observations.

- b. Prepare a properly labelled graph that compares some aspect of your data. Write a brief description of your graph's purpose. (5)

Answers will vary. Check for

- *proper plotting and labelling*
- *a description of the graph's purpose*

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2. a. Prepare a written report on your plant or crop. Be sure to use your outline from Assignment 3 as a guide to help organize your information. Be sure to include

- the origin and history of plant cultivation (3)
- the environment required for growth (3)
- where it is grown (2)
- how it is grown (3)
- how it is sold (3)
- how it is processed (3)
- what food or other products are made from it (3)
- other information of interest to you (5)

Check to see that answers are supplied for each of the main components suggested in the question. Give one mark for each point in the answer, up to the maximum suggested for each component.

- b. Prepare a properly labelled graph that compares some aspect of your information. For example, you may want to compare the consumption of similar foods between regions, or the production of similar foods between countries. Write a brief description of your graph's purpose. (5)

Answers will vary. Check for proper plotting and labelling, and for a description of the graph's purpose

Section 6: Activity 5

This activity supplies guidelines and information which should be followed to complete the assignment for the final report. After reading the information, students should complete Assignment 5 in Part B: Project 1, which is located in the Module 4 Assignment Booklet.

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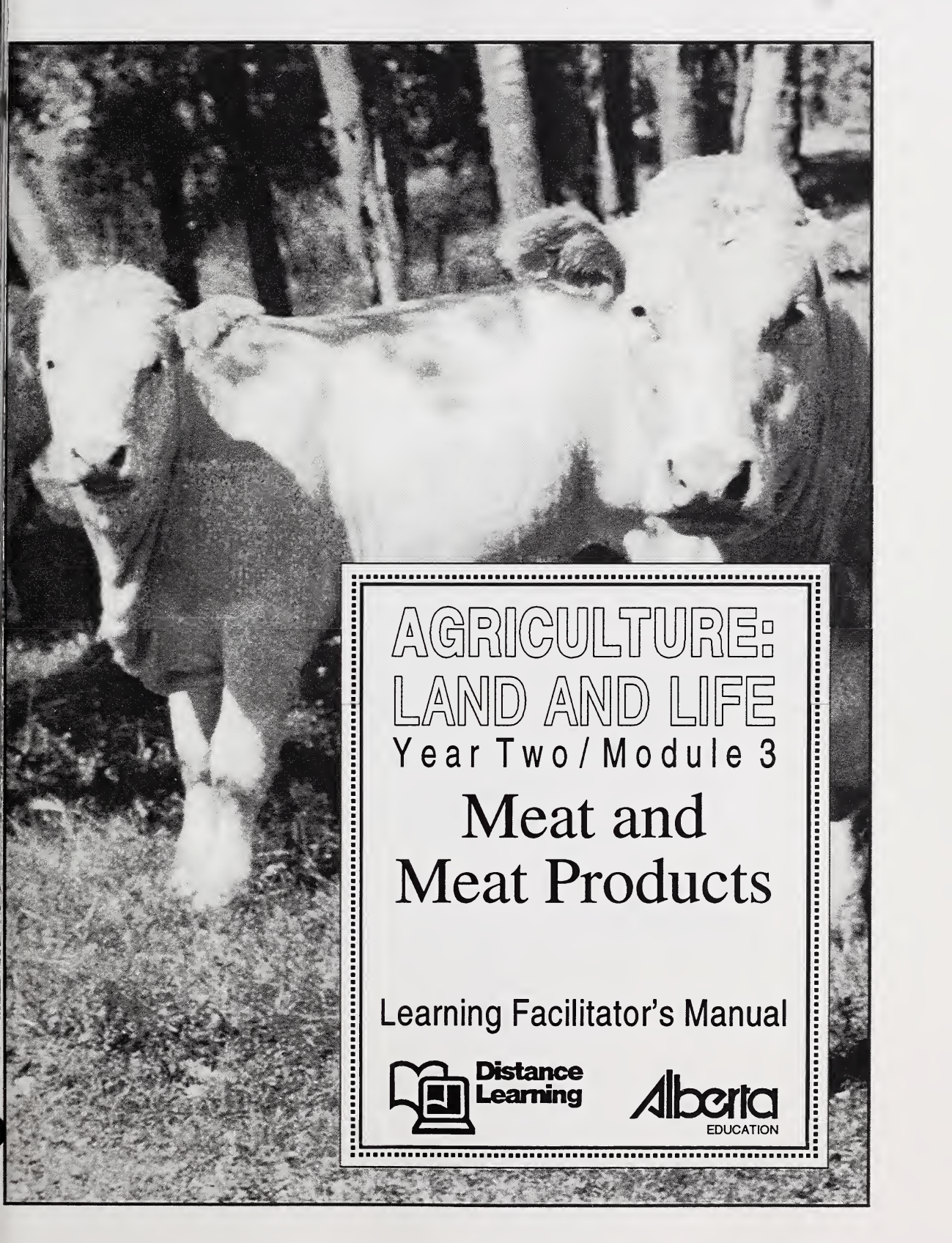
Part B: Project 1: Assignment 5

Evaluate the success of your project. Were your original goals achieved?

Explain why or why not. (5)

Answers will vary. Some projects may not be completed due to a lack of time, the death of the plants, or other reasons. This does not mean that the project is not a success – if students can explain what went wrong, they will have learned something.

Check that students have completed all assignments for their plant project and have this part ready to submit when they have completed both this project, and the animal project, which is described in Module 3.

A black and white photograph of two calves in a field. One calf is in the foreground, looking towards the camera, while the other is slightly behind and to the left. They are standing in a grassy area with trees in the background.

AGRICULTURE: LAND AND LIFE

Year Two / Module 3

Meat and Meat Products

Learning Facilitator's Manual



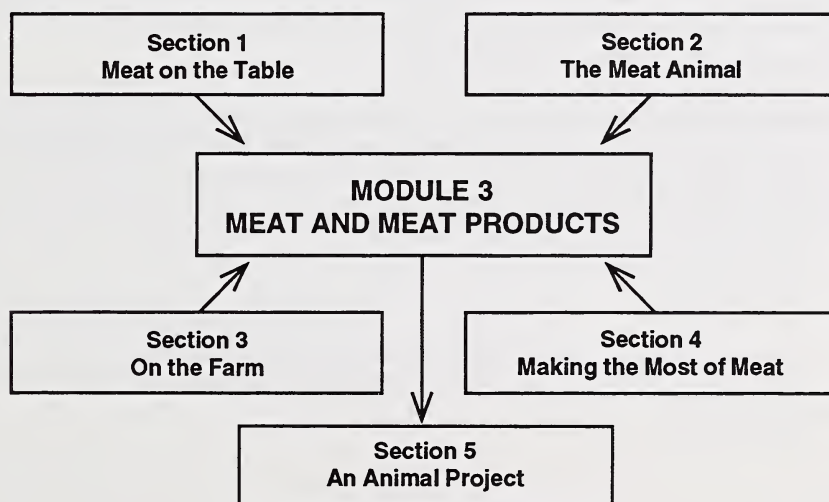
Alberta
EDUCATION

Module 3: Meat and Meat Products – Overview

This module uses a case study approach. The intent of this module is to provide a practical examination of production, processing, and marketing aspects of a particular agricultural industry. The theme is similar to the one used in Module 1: Year One of the program; however, the consumer emphasis has been replaced by an emphasis on nutrition.

In this module students will

- discover the nutritional value of meats and alternate foods
- investigate why people eat meat and what they like about meat
- consider the important aspects of caring for livestock
- visit several farms to see how meat animals are raised
- follow the many paths of meat from the farm to the table
- examine the wide range of products made from meat animals
- consider some of the controversial issues involving meats and modern methods of livestock rearing



Evaluation

The student's successful completion of all assignments in the Assignment Booklet will depend on practice obtained while doing the various activities in the Student Module Booklet. In this module students are expected to complete four section assignments.

The following distribution of marks is suggested in determining the student's grading for this module.

Section 1 Assignment	25%
Section 2 Assignment	25%
Section 3 Assignment	26%
Section 4 Assignment	<u>24%</u>
TOTAL	100%

Note: The evaluation of the assignments for this module does not include an evaluation of Section 5: An Animal Project. The project is to be evaluated as part of Module 4.

Although the value of each module for the Agriculture: Land and Life Year Two course is the decision of the classroom teacher, it is suggested that Module 3 be worth 25% of the total final grade, based on an equal weighting of the four modules in this course.

Project Work

If this is the first year that the student is in the Agriculture: Land and Life program, then the student does not need to complete Section 5: An Animal Project. Instead, Part A of Module 4: What Is Agriculture? will need to be completed.

If the student has previously taken Year One of the Agriculture: Land and Life program, then he or she has an opportunity to pursue an interest in particular topics during the Year Two program. Students are expected to complete two individual projects as part of the requirements for this course. Descriptions for a plant project (Project 1) are included as part of Module 2, and descriptions for an animal project (Project 2) are included as part of this module. Approximately 7.5 hours are allowed for the book work for each project. The actual time spent pursuing each of the projects will be more than 7.5 hours.

In Section 5 of the module booklet, students will find instructions on how to complete an animal project of their choice. A report of their project will be submitted in the Module 4 Assignment Booklet, Part B.

There are 50 marks for the animal project. The following is a breakdown of marks for the animal project assignments that are to be submitted with the Module 4 Assignment Booklet, Part B.

Assignment	Value
Project 2: Section 1	5
Project 2: Section 2	5
Project 2: Section 3	10
Project 2: Section 4	15
Project 2: Section 5	10
Project 2: Section 6	5
TOTAL MARK	50

Materials Needed for Module 3

Most of the materials needed for Module 3 can be obtained when students are ready to do an activity. However, in order to assist students effectively in their study of this course, it may be helpful to preview Module 3. This will give you an idea as to how the topics are developed; it will also give you an overview of the material needed in the module. In some cases, if the materials suggested are not readily available, the learning facilitator may be able to substitute suitable materials for the student so that the activities can be completed successfully.

Media

To obtain the videotape resources for this module, contact either your regional media centre or the ACCESS Network.

The following two video programs are suggested if students use the optional media pathways in Module 3:

- *The Sun Changers*, VHS videotape, 10 min.
- *Cattle Option*, VHS videotape, 16 min.

Section 1: Meat on the Table

The emphasis of this section is on the nutritional value of meats. Although answers may vary for some activities, students should be able to discuss the nutritional value of meats and appreciate how consumer needs and preferences influence the production, processing, and marketing of meat products.

Section 1: Activity 1

1. What are your favourite meats?

Answers will vary.

2. How do you like them prepared?

Answers will vary.

3. In the following space list some characteristics of meat dishes that aid you in telling them apart?

Answers will vary. They may include the following:

- *colour: Meats can be light, dark, or coloured artificially with ingredients in a recipe.*
- *taste: Meat from different animals has a distinct flavour that you learn to recognize. It adds flavour to many recipes.*
- *texture: Different meat cuts have textures that people can identify. You would never confuse a hamburger with a steak, even though both may be from the same part of the animal.*
- *smell: A cooked meat or meat recipe can produce odours that you recognize long before the meat reaches the table.*
- *preparation: Different recipes require special cuts of meat. Pork ribs, for instance, are often prepared with a sweet-and-sour sauce.*

4. Circle your favourite food in the following pictures.



Stew



Steak



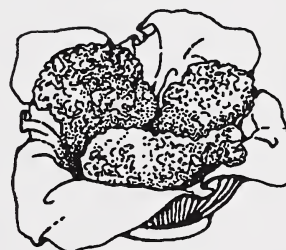
Hamburger



Pork Chops



Hot Dog



Fried Chicken



Spaghetti & Meatballs



Beef Liver



Roast

Answers will vary.

5. Use the headings in the following chart and try to describe the food that you have circled, as in the example.

Colour	Taste	Texture	Smell	Preparation	Food
brown	spicy	tender	charred	barbecued	barbecued steak
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Let a partner (a friend, brother, sister, parent, etc.) try to guess your favourite food. Change places. Try to guess your partner's favourite meat dish. Then try another food if you would like to.

Answers will vary. Students should work with a partner for this activity to help identify descriptive words.

6. Which of the following meats would represent a tender cut? Rate the following as 1 – more tender, or 2 – less tender.

Cut	Part of the Animal	Your Rating
sirloin steak	back of a beef animal	<u>1</u>
pork chop	back of a hog	<u>1</u>
tenderloin	long muscle beside backbone	<u>1</u>
ribs	enclose lungs and organs	<u>2</u>
leg of mutton	leg of a sheep	<u>2</u>
lamb riblets	front portion of the flank	<u>2</u>
veal cutlet	upper back leg of calf	<u>2</u>
rabbit leg	legs	<u>2</u>
chicken breast	breast	<u>1</u>

The answers are also included in the Appendix of the Student Module Booklet.

7. Decide on the best cooking method for each of the following cuts of meat. If you are not sure which part of the animal the cut comes from, turn to the Appendix diagrams.

Cut of Meat	Moist or Dry Heat	Describe Your Favourite Cooking Method
prime rib roast	<i>dry</i>	<i>roast or barbecue</i>
sausage	<i>usually dry</i>	<i>fry</i>
sirloin steak	<i>dry</i>	<i>broil, barbecue</i>
chicken breast	<i>moist or dry</i>	<i>stew, braise, broil, fry, or barbecue</i>
round steak	<i>moist</i>	<i>braise, stew, or pulverize and stir fry</i>
pork chops	<i>moist or dry</i>	<i>almost any method is used</i>
chuck steak	<i>moist</i>	<i>braise, stew</i>
lamb chop	<i>dry</i>	<i>fry, broil, barbecue</i>
leg of lamb	<i>dry</i>	<i>roast (lambs are young)</i>
veal cutlet	<i>moist</i>	<i>braise or stir fry</i>
chicken wings	<i>moist or dry</i>	<i>stew, broil, fry, or barbecue</i>

Note: There may be other answers possible here. For example, if a student comes from a culture outside of North America, he or she may possibly use different methods than those stated in the chart.

The answers are also included in the Appendix of the Student Module Booklet.

Section 1: Activity 2

1. Do you know your food groups?

Which Food Group?



Each food listed below fits into one or more of the four food groups. Put the correct number or numbers beside each food to show which food group or groups it belongs to.

bread	<u>3</u>	ice cream	<u>1</u>	turkey	<u>2</u>	lettuce	<u>4</u>
potato	<u>4</u>	meat loaf	<u>2</u>	dried beans	<u>2</u>	tuna	<u>2</u>
muffin	<u>3</u>	corn cereal	<u>3</u>	rice	<u>3</u>	liver	<u>2</u>
eggs	<u>2</u>	beef stew	<u>2, 4</u>	hot dog	<u>2, 3</u>	cheese	<u>1</u>
pizza	<u>3, 1</u>	hamburger	<u>2</u>	apple	<u>4</u>	spaghetti	<u>3</u>
roast	<u>2</u>	yogurt	<u>1</u>	steak	<u>2</u>	grapes	<u>4</u>

The answers are also included in the Appendix of the Student Module Booklet.

Check student responses for this activity. If students had trouble with this activity, they should carefully review the information on the four main food groups contained in the Student Module Booklet. Students should then complete Canada's Food Guide Scorecard in question 2 for foods eaten during one day, and examine the scorecard at the end of the day.

¹ Beef Information Centre, Toronto, Ontario, for the material from *Canada is Cattle Country*. Adapted by permission of the Beef Information Centre, Toronto, Ontario.

2. Use the examples from the previous page as a guide to complete the following Food Guide Scorecard for the food you eat during one day.

In the daily scorecard the dark boxes represent the minimum recommended number of servings. The lighter boxes represent optional additional servings. Foods high in sugar and fats, or of little nutritive value, are placed under Additional Foods and Beverages.

For each food that you eat today, shade in the appropriate box in the chart. Make use of the following examples:

- For a slice of toast shade in one box of the breads and cereals group.
- For one egg shade one-half box of the meats group.
- For combination foods score each ingredient in the following way; for one serving of cereal with milk, shade in one box of the cereal group and one box of the milk group.
- For fruits and vegetables shade in the appropriate box for each serving, but add an F to the shaded boxes that represent fruit servings and a V to the shaded boxes that represent vegetable servings.

FOOD GUIDE SCORECARD

Fruits and Vegetables 4 to 5 servings					
Breads and Cereals 3 to 5 servings					
Milk and Milk Products 3 to 4 servings					
Meat, Fish, Poultry & Alternates 2 servings					
Additional Foods and Beverages					

Discuss student scorecards. The best scores would show all of the dark squares shaded and at least two servings of fruits and two servings of vegetables. Any dark square not filled in means students are missing a source of essential nutrients. Ask students to identify the missing nutrient and how they can increase their intake of it.

3. Try to balance the following menus using a variety of meat and alternate proteins so that a meat eater, a non-meat eater, and a complete vegetarian all receive their required daily servings of complete proteins. Assume all of their daily protein requirements are obtained in one meal. Monday's menu has been done for you.

Canada's Food Guide recommends two servings of meat or alternates each day.

Note: Use Table 1: Protein Content of Some Common Foods, located in the Appendix, to find the portion sizes in one serving of various meats and alternate foods.

	Meat Eater	Non-meat Eater	Vegetable Diet
Monday	pork chop 180 g	2 eggs 60 mL peanut butter	250 mL kidney beans 250 mL brown rice
Tuesday			
Wednesday			
Thursday			
Friday			

Answers to this activity will vary but the following rules should apply:

- *Meat eaters will have two servings per day. They can select from different kinds and cuts of meats.*
- *Non-meat eaters can use alternate animal sources. They will need to choose foods from Breads and Cereals, plus Milk and Milk Products, to obtain a proper supply of complete proteins.*
- *Vegetarians must eat a combination of vegetables to get all of the proteins that they need. They should pair servings according to special rules (simplified in the Student Module Booklet). To obtain the recommended daily supply of complete proteins, vegetarians need to select complementary proteins from a choice of legumes plus cereals, or legumes plus nuts.*

Table 1: Protein Content of Some Common Foods, is reproduced from the Appendix for reference to portion sizes in one serving of various foods from the Meat, Fish, Poultry and Alternates group.

TABLE 1 – PROTEIN CONTENT OF SOME COMMON FOODS				
(Each quantity represents one serving)				
Food		Portion Size	Weight (g)	Protein (g)
Meats	steak – lean		90	26
	ground beef	1 pattie	90	24
	beef liver	1 piece	90	23
	pork chop	1 chop	90	23
	pork sausage	4 links	60	12
	wieners	2	90	10
	lamb	1 chop	90	25
	chicken	2 drumsticks	90	25
	moose		90	31
	codfish	1 fillet	90	25
Dairy	whole milk	250 mL	125	8
	cheddar cheese		45	11
	eggs	2	90	12
Legumes (bean crops)	soybeans	250 mL	90	21
	kidney beans	250 mL	195	15
	lima beans	250 mL	200	15
	green peas	250 mL	169	8
Nuts	peanut butter	60 mL	60	20
Cereals	whole wheat bread	2 slices	50	2
	brown rice	250 mL	180	5
	breakfast cereals		100 (avg.)	3

4. Based on the exercise just completed, identify two advantages of using meat as a protein source

Meat is a convenient source of complete proteins. Meats can be used to give variety to your diet. They are also good sources of vitamin B and iron. A specific quantity of meat contains more proteins than the same quantity of vegetables.

¹ Health and Welfare Canada for the data from *Nutrient Value of Some Common Foods*, Health and Welfare Canada. Revised 1987. Adapted by permission of the Minister of Supply and Services, Canada.

5. Circle the best method for each person in the following situations to solve their individual problems. Think carefully about your answer in each case so that you are able to explain to your learning facilitator why your choice is best.

- a. Mary wants to look good in her bathing suit this summer. Should she

- i. go on a crash diet and skip meals

This is not a good idea. Crash diets often omit essential foods while substituting easily consumed fast foods.

- ii. go on a vegetarian diet

Vegetarian diets are difficult to manage. It is also difficult to obtain necessary vitamins and proteins.

- iii. buy a new bathing suit

Buying a new bathing suit is a good idea (but this may not be enough).

- iv. reduce portions of food, maintain a balanced diet, and eliminate snacks

This is the best solution.

- v. keep eating as usual but exercise more

This is a good idea for toning her body.

- b. Roger is preparing for a track and field meet. As part of his training, he should

- i. have a balanced diet but increase total calories to make up for his increased activity

This is the best choice.

- ii. eat high energy food like chocolate cake before competing

Many athletes use this approach. The trick is not to overdo it!

- iii. eat an extra snack before bedtime

Bedtime is a bad time to eat a lot of food, because you will be inactive for seven or eight hours.

- iv. lose weight; extra pounds slow you down

The right kind of weight does not slow you down. People who exercise have larger muscles and less excess fat than those people who do not exercise. Dieting is not recommended for an active athlete.

- c. Tom's dad is overweight. Circle the things in the following list that his dad might do to lose weight:

- | | |
|---------------------------------|-------------------------------------|
| • fry steak | broil steak |
| • eat roast beef with gravy | eat roast beef without gravy |
| • trim fat before cooking | cook meat with the fat still on it |
| • eat broccoli and cheese sauce | eat broccoli and lemon sauce |
| • have yogurt for dessert | have ice cream and cake for dessert |

6. If many people seek to lower their intake of fat and cholesterol by eliminating meat from their diets, how should meat producers respond?

Health concerns may prompt consumers to reduce their meat consumption. This will not be good for people who produce, process, and market livestock. But if the preference for lean meat continues, producers will adjust and give consumers the products they demand.

7. Find the best source of each of the following:

	Meat Source	A Vegetable Source
Iron	<i>beef liver</i>	<i>kidney beans</i>
B vitamins	<i>beef liver, lamb, chicken, or pork chops</i>	<i>peanuts, kidney beans</i>
Thiamine	<i>beef liver, pork chops, or lamb</i>	<i>peanuts, kidney beans</i>
Niacin	<i>beef liver, chicken, or pork chops</i>	<i>peanuts</i>
Riboflavin	<i>lamb</i>	<i>spinach, broccoli</i>
Vitamin A	<i>beef liver</i>	<i>spinach, broccoli</i>

Compare student answers with those in the table. Please note that the B vitamins include Thiamine, Niacin, and Riboflavin.

8. Why is it important to balance your diet by eating a variety of foods?

Each food makes its own contribution to nutrition. By having a balanced diet you are assured of getting all of the nutrients that you need. Omitting or lowering your intake of any food group carries with it the risk of malnutrition.

Section 1: Activity 3

Students are to do Part A or Part B.

Part A

Find the prices of each of the following items at your local meat market or grocery store. Explain the price differences in each group.

	Price/100 grams	How do you explain this difference?
Group I		
sirloin steak	<i>Prices will vary.</i>	<i>You pay extra for tender prime cuts of meat that have no greater food value than less expensive cuts. Cheaper cuts of beef can be ground up to produce a versatile low-cost meat.</i>
round steak		
lean ground beef		
Group II		
fresh chicken	<i>Prices will vary.</i>	<i>Fresh chickens are ready to cook, but they do not stay fresh! This is a convenience that costs. Fresh chickens are also produced on a smaller scale than frozen chickens. The value of chicken nuggets is increased by the cost of processing, and the removal of waste.</i>
frozen chicken		
chicken nuggets		

Part B

1. Imagine that you have \$100 to spend on groceries for your family this week. Thirty percent of this amount (or \$30) will go for meat. You will need about 500 grams of meat for each meal and perhaps some processed meats for lunches, etc. See how far your money will go in the local supermarket.

	Meat	Cost/100 grams	Amount	Total Cost
Monday				
Tuesday				
Wednesday				
Thursday				
Friday				
Saturday				
Sunday				
Total Cost for the Week				

Answers will vary. Be aware that some students may see this as an impossible task!

2. How could your family obtain the same nutrition from meats but spend less money?

Your family could buy cheaper cuts of meat and use moist cooking methods to improve tenderness.

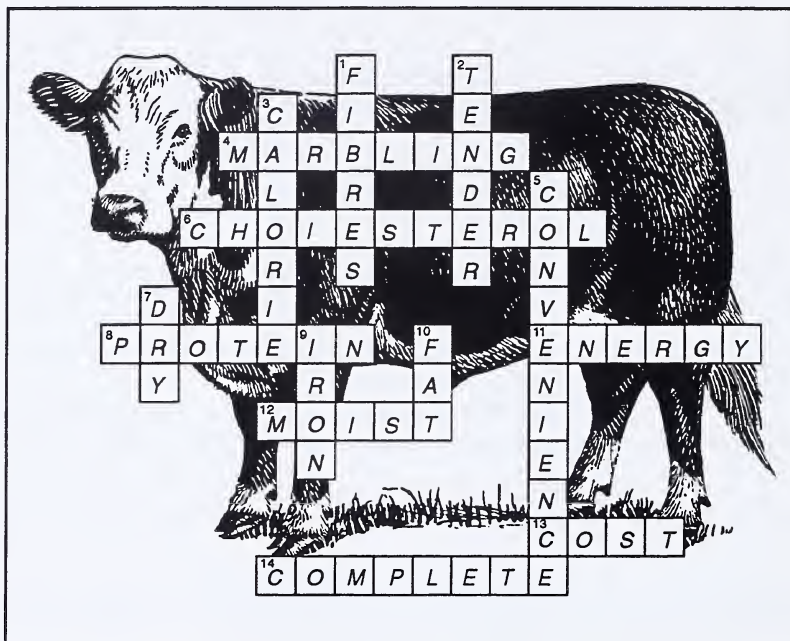
Section 1: Follow-up Activities

Encourage students who are having difficulty with this section to complete Part A and Part B of Extra Help. Part A involves reading a summary of Section 1 and Part B involves completing a crossword puzzle as a review of the section. Other students may complete one or more of the Enrichment activities. All students should complete at least one Enrichment activity.

Extra Help

Complete the following crossword puzzle as a review of this section.

A PUZZLE ON THE HOOF



Word List

tender
fat
dry
cholesterol
energy

fibres
convenience
protein
iron
moist

calorie
marbling
cost
complete

Across Clues

4. This describes the streaks of fat that run through lean meat.
6. This substance, created from fats, has been linked to heart disease.
8. For most people meat is the main source of this nutrient.
11. This is required to power peoples' activities, much like the gas in a car.
12. This method of cooking is used for less tender meats.
13. This is an important consumer consideration when buying meats.
14. This type of protein (found in meats) contains all of the amino acids needed by the human body.

Down Clues

1. Muscle tissues are bound together by two types of connective _____.
2. The better cuts of meat are valued by consumers because they are _____.
3. This unit is often used to compare the food energy found in various foods.
5. Consumers are looking for this to make life easier, but it often means they will pay more.
7. This method of cooking is best for tender cuts of meat.
9. Red meats and liver are an excellent source of this nutrient.
10. This is the most concentrated form of food energy used by the body.

Enrichment

Enrichment A

1. Obtain a calorie counter food chart from a health food store or health clinic. Some cookbooks also have tables in the appendix. List all of the foods that you eat for one week and write the approximate number of calories contributed by each food in your diet. At the end of the week find
 - the total calories each day
 - the total calories for the week
 - the total calories from meat and meat products
 - the average number of calories consumed per day

The table at the end of Enrichment A is supplied to help you record this information.

Check to see that the chart, MY FOOD INTAKE at the end of Enrichment A in the Student Module Booklet, has been completed. Discuss the survey results and the answers to questions 2 to 5 with the students.

2. At which meal do you consume the most energy?

Most students will answer that they consume the most energy at the evening meal.

3. Are you consuming more than 2500 calories each day?

Answers will vary. Compare answers to the information students gave in the chart under the column "Total calories for each day."

Note: This is not necessarily a problem if you are very active or if you are a person with high metabolism; that is, you use more than an average amount of energy just for growth and normal activity.

4. How important is meat in your diet? Add up the total number of calories from meat and equivalent foods and compare them with the total calories for the week.

Answers will vary.

5. List the other foods you eat that contain fats.

These foods include pastries and baked desserts, dairy products, chocolate, nuts, and vegetable oils.

Students should not attempt to change their diets based on this survey. If they have concerns, they should talk about them with their doctor, nutritionist, or home economist.

Enrichment B

Prepare one of the meat recipes included in the Appendix or use another recipe. Think about how your method of cooking takes into consideration the quality of meat you are using.

Note: Do this activity under the supervision of your learning facilitator.

Students may ask you to sample their cooking, and discuss with you how their recipes take into consideration the quality of meat they are using.

Enrichment C

Research and write a report on an unusual animal that is raised for meat. Encyclopedias or nature magazines may provide you with information.

Investigate to find out

- where the animal is raised
- where it is consumed
- how it is prepared to be eaten by humans
- the value of the animal as a meat animal

Include any nutritional information that you discover.

Students may wish to discuss their report with their learning facilitator and make a presentation to their family, or to other agriculture students.

Section 1 Assignment

Students are to do either Part A or Part B. A choice is incorporated into this assignment to accommodate students who prefer to answer questions on alternatives to meat instead of on meat products. Both parts of the assignment require an examination of the same factors which affect consumer demand for meat products.

Part A

In this assignment you are asked to prepare an advertisement for a meat product. Choose a type of meat as a focus for your advertisement (beef, chicken, pork, lamb, etc.). Use information from Section 1 in your presentation.

Make your presentation on the two response pages, or use larger-sized pages if you wish. Or you may wish to create your advertisement on audiotape or videotape. Remember, it must be something you can mail in for marking.

Choose a format for your advertisement: (8)

- Create a magazine advertisement which covers two pages; combine words and pictures to deliver a message.
 - *organization* (2)
 - *effective use of information from Section 1* (2)
 - *effort* (4)
- Record a TV commercial on videotape, or write a script that includes characters, costumes, dialogue, and your selection of music and setting.
 - *organization* (2)
 - *effective use of information from Section 1* (2)
 - *effort* (4)
- Record a radio commercial on audiotape, or write a script for a radio commercial that includes sound effects, characters, dialogue, and narration.
 - *organization* (2)
 - *effective use of information from Section 1* (2)
 - *effort* (4)

Include information on

- why people might enjoy meat (4)

Reasons may include flavour, texture, variety, and convenience.

- a method of preparation of your choice (3)

Answers will vary.

- nutrition (5)

Meat provides a source of proteins, complete proteins, energy from fats, vitamins, and iron.

- benefits, convenience, and cost (5)

Answers may include health benefits, convenient protein source, readily available, same nutritional value in low-cost selections as in expensive cuts, easy to prepare, and the fact that many interesting recipes are available to provide variety in meal planning.

Part B

Note: You do not need to complete Part B if you have already done Part A.

In this assignment you are asked to prepare a report that explains how alternate foods can be prepared to obtain the same nutrition offered by meats. Use information from Section 1 in your presentation.

You should include information on the following:

- a list of some alternatives to meat (5)

Alternatives to meat include eggs, nuts, peanut butter, lentils, and soybeans. At least five alternatives should be listed.

- why people might enjoy alternatives to meat (2)

Reasons will vary. At least two reasons should be given.

- several methods of preparation (your choice) (4)

Answers will vary.

- how alternate foods can meet the same nutritional needs as meat (5)

Alternate foods provide alternate sources of proteins, complete proteins, energy from fats, vitamins, and iron.

- a description of benefits, convenience, and cost (4)

Answers will vary to support alternate choices.

- data from your own research (5)

Award marks for original ideas based on research. Allow one mark for each point made.

Sources of information on this topic are to be found in nutrition booklets, Section 1 of the Module Booklet, tables of nutrients in common foods (in the back of some cookbooks), or from the Appendix in the Module Booklet. You may also obtain information from a doctor, nurse, or home economist.

Section 2: The Meat Animal

The purpose of this section is to acquaint students with basic information about the selection and care of farm animals. Selection, proper nutrition, and health are important for the production of quality meats from livestock.

Section 2: Activity 1

1. Do you have a pet? If so, describe your pet and mention some of the things that it does for you. What must you do for it?

Answers as to why people have pets and what pets do for their owners will vary. Pets must be cared for. People feed, water, and usually exercise their pets. They also provide health care, pick up wastes, and spend spare time with their pets. Most importantly, pets and people have an emotional attachment.

2. Think about Susan's 4-H calf. What special care did it receive? How are farm animals different than pets?

Susan carefully fed her calf with a proper diet, provided proper health care, and groomed and trained her calf. But there are differences between pets and farm animals. Although people also feed, water, and occasionally exercise farm animals, along with providing health care and waste pick-up, the hours that people and their farm animals spend together are purposeful working hours. The relationship is businesslike and friendly. There is less emotional attachment of the type people have for their pets.

3. Make up some rules that you think might apply to taking care of farm animals.

Answers will vary. Students can compare their rules with the following rules that have been included in the Appendix of the module booklet:

- *Freedom from malnutrition*
- *Freedom from thermal or physical discomfort*
- *Freedom from injury and disease*
- *Freedom to express normal social behaviour*
- *Freedom from fear*

Compare these guidelines and rules made up by students. Discuss any differences of opinion.

Section 2: Activity 2

Students can obtain answers to question 1 in one of two ways:

- They may watch the videotape titled, *The Sun Changers*.
- They may read the information in the Student Module Booklet which outlines what all ruminants have in common.

1. Which of the following animals are ruminants? Put a ✓ by any that you know are ruminants.

The animals marked with a ✓ are ruminants. The rest are nonruminant plant eaters.

Milk cow	✓	Horse	
Chicken		Moose	✓
Deer	✓	Sheep	✓
Hog		Rabbit	
Mouse		Goose	

2. If you have a pet at home, you probably also have a book on how to feed and take care of it. If not, select an animal that you would like to have as a pet and read a pet food label to determine what ingredients are in the food.

Write down the ingredients in your pet's food under the following headings. (If only the percentages are given, write them instead.)

Protein	Fats	Fibre (roughage)	Carbohydrates	Minerals	Vitamins

Answers will vary but all categories should be represented.

3. Many feeds also list the amount of moisture included in them. Why is this?

Feed is measured in "dry weight." Moisture, which adds weight to feed and must be taken into account, is important to the digestive process.

4. On the following page some feed sources are illustrated. Match each nutrient with a source, much as a farmer does, to produce a balanced diet for each animal.

calf	Proteins	<i>milk</i>
	Carbohydrates	<i>milk</i>
	Calcium	<i>milk</i>
	Vitamins	<i>milk, injections</i>
beef cattle	Proteins	<i>forage crops</i>
	Carbohydrates	<i>grain</i>
	Minerals	<i>salt, supplements</i>
	Vitamins	<i>supplements, injections</i>
hog	Proteins	<i>soy meal, field peas</i>
	Carbohydrates	<i>grain, corn</i>
	Minerals	<i>supplements</i>
	Vitamins	<i>injections, supplements</i>

Section 2: Activity 3

In this activity students are to decide what type of livestock to raise in various different situations that are stated in the Student Module Booklet. This activity is nonstructured to allow students to

- use their background to arrive at original solutions
- consider some of the factors that affect decisions
- realize some of the unknowns that must be overcome

1. What type of animal would you raise?

Answers will vary, but cattle would be a good choice. The land is well situated for forage crops that require a lot of moisture.

2. What changes would you make to the farm?

Cattle require a minimum investment in buildings and equipment. Changes could include new fencing, open shelters, corrals, and feed storage. Don't forget that income from baled hay will not be available until the cattle are sold.

3. What type of animal would you raise?

Answers may vary from exotic animals ranging from elk to ostriches, but sheep are a good choice, because they require similar facilities and feed as do cattle. Lambing occurs at a different time of the year than does calving.

4. What changes would you make to the farm?

Changes required for sheep are few – open shelter and a barn for lambing will be needed. A different feeding arrangement may be required.

5. What type of animal would you raise?

Answers will vary. There are many possibilities depending on the amount of time and money that a person has to put into a farm. Horses, sheep, cattle, hogs, poultry, or exotic animals are all possibilities. The cost of facilities and equipment is a major consideration.

6. What changes would you make to the farm?

Livestock such as hogs and poultry will require indoor housing. There is not necessarily enough land to grow all your feed so some may have to be purchased. Energy costs are also high for indoor housing.

Because parents may be more familiar than the learning facilitator with the area in which the students live, students should discuss their answers to questions 7, 8, and 9 with a parent or another knowledgeable adult.

7. What is the main type of farming in the area where you live?

Answers will vary.

8. Beef livestock production is common in many parts of Alberta. What type of livestock is most common in your area?

Answers will vary.

9. How is your area suited for producing this type of livestock?

Answers will vary but should include information about the availability of feed.

Section 2: Activity 4

1. From the three examples given, choose the best dog for the following purposes.

- a. You live in a small home and want an inside dog for company and to serve as a watchdog.

Poodle

- b. You are a hunter and want an outside dog that can flush game birds from the bush and retrieve ducks from the water.

Golden retriever

- c. You have a business that requires a guard dog to discourage intruders after hours.

German shepherd

2. Name the cattle which might be crossbred to obtain the following characteristics:

- a. a hardy animal with good mothering instincts

Cross a Hereford with a Simmental.

- b. a hardy animal that grows rapidly and produces a lean carcass

Cross a Hereford with a Charolais.

- c. a large animal that will produce lean meat

Cross a Simmental with a Charolais.

Note: In reality, such crosses may not get the suggested results! Experimentation and careful record keeping are needed to predict which characteristics will be passed on.

3. Solve this problem.

A rancher recently discovered that many of her crossbred cows had udders with very large teats. These teats were too large for newborn calves to suck. How can the problem be corrected, while still using the same crossbreed?

Culling cows with undesirable traits may reduce the frequency of the trait in future generations. It most certainly eliminates the problem for the present!

Section 2: Activity 5

Students are to determine the answer or answers to each of the following questions by circling the correct letter or letters. Discuss these situations and each action with your students. Safety around animals is an important consideration.

1. Trouble may begin at the farm gate. A large, strange, barking dog approaches. What should you do?

- a. Get out of the car and pet it.

This is a bad idea if you don't know the dog.

- ☒ b. Drive further and honk your car horn to alert the farmer. Get out only when you are told that it is safe.

This is the best idea. If no one else is around you would not want to act like an intruder.

- c. Bribe the beast with some meat and run for the door while the dog is busy.

This is a silly idea! What if the dog can run faster than you?

2. The bull you want to buy is in an outdoor pen. You want a closer look. How can you get closer?

- ☒ a. Ask the farmer to lead it, with a rope through its nose ring, into a smaller pen.

This is the recommended way to handle a bull.

- b. Go into the pen but don't turn your back.

This approach is not advisable. Bulls can move pretty fast, especially if you are not looking.

- c. Ask the farmer to yell and throw stones to get the bull closer to the rail.

No farmer would intimidate a valuable animal in this way.

3. You are asked to look at a sow with piglets. The sow appears to be ill. She is in an open stall inside the barn. How should you go about "looking" at the sow?

- a. Examine the animal through the slats of the pen using your bare hands.

This is not a good idea. Unless you disinfect your hands, the sow can transmit diseases to other animals.

- ☒ b. Leave the animal alone but get its medical history from the farmer.

An approach of this kind is probably the best and safest idea, especially if you are not a veterinarian.

- c. Go into the pen for a close examination. Remove the piglets to check for infection as well.

The removal of piglets by a stranger might excite an unrestrained sow.

- d. If you must examine the pig, use a farrowing pen to restrain it. Examine the source of infection while wearing disposable rubber gloves.

Any veterinarian would consider this to be the best approach.

4. Several cattle are kept in the barn for calving over winter. It is bitterly cold outside. The farmhand thinks there isn't time to clean the barn properly. What should the worker do?
- a. Herd the cattle into one side of the pen while cleaning the other side manually, or feed the cattle in one side while cleaning the other.

It is a bad idea to work in a pen with livestock.

- b. Feed the cattle outside, clean the barn manually, and later herd the animals inside.

This is a better idea.

- c. Leave the pen dirty. Clean it next week when the weather is better.

Dirty pens are a safety hazard – this is a worse idea.

Section 2: Follow-Up Activities

Extra Help

Students are to use the words given in a word list in the Student Module Booklet to complete this review.

People have long depended on animals for *meat* and *transportation*. They have also supplied people with such things as *leather*, *wool*, *feathers*, and *manure*. The most important group of farm animals are called *ruminants*.

Nutrition is important for healthy animals, just as it is for humans. Animals obtain their energy from carbohydrates. The nutrients that animals need for growth and reproduction are the *proteins*.

They must also have *water*, *minerals*, and *vitamins*. High protein foods such as *milk* and *soybean meal* are important for young animals. As they mature they consume high carbohydrate cereal grains such as *barley* and *oats*. Roughage from *forage* crops makes up 80% of their diet.

Each *breed* of cattle has certain desirable traits. By *crossbreeding*, a livestock producer can improve the stock by combining the traits of two breeds. To maintain the health of a herd, a producer *culls* animals which show undesirable traits. To protect yourself around large animals, remember that no animal is 100% *reliable*.

Enrichment

Enrichment A

Choose a legume or forage from the previous eight examples for each of the following situations:

- a grass for city lawns

Kentucky bluegrass

- a rich forage to make hay for dairy cattle

Alfalfa

- a grass to cover soil in a dry area to be used only for grazing

Ryegrass

- a forage for an area with cool, short summers, and lots of rainfall

Clover

- a legume for grazing that does not cause bloat as other legumes sometimes do

Sainfoin

- a forage for horses

Timothy

- a drought-resistant grass for grazing

Crested wheatgrass or Smooth brome grass

Students may have chosen an alternate grass for some of their answers. In these cases discuss these answers with the students to see why they would prefer the grass they selected, instead of the suggested answer.

Enrichment B

1. Visit a cattle auction or bull sale to find out what a cattle buyer looks for in a beef animal.
2. On some of your notepaper, record the prices paid for bulls of different breeds. Try to find the reasons for some of the price differences. Be prepared for a shock: bulls can be very expensive animals.

If students choose to do Enrichment B, discuss their trip to the auction and the reasons for price differences, if any, between animals of different breeds.

Enrichment C

Research one type of disease that can affect a farm animal or pet. Write a report which includes

- symptoms
- causes
- treatment
- prevention

Answers will vary, depending on the type of disease researched and the type of animal affected by the disease.

If you are in a large group, you may wish to consider class presentations. You may be able to select one or two animals to research thoroughly.

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Section 2 Assignment

Both Part A and Part B must be completed for Assignment 2.

Part A

In this assignment imagine that you have a farm and want to produce livestock.

Choose a farm from the following three options.

	Small Acreage	Grain Farm	Ranch
Size of Farm	4 hectares (10 acres)	256 hectares (1 section)	512 hectares (2 sections)
Type of Land	acreage with pasture	cultivated farmland	1/4 cultivated 3/4 grazing
Moisture	irrigated	adequate	dry
Crops	alsike clover for grazing barley	alfalfa for hay and grazing fall rye for hay	bromegrass for hay and grazing
Buildings	home small shed	home barn equipment shed grain bins	home small barn equipment shed grain bins

1. Which type of farm did you choose? Explain the reasons for this choice in your own words. (2)

Clue: Use the information from the chart in Activity 3: Planning for Livestock and other information from Section 2 to help you with questions 2 to 5.

Answers will vary depending on the student's experience. This question is included in an attempt to match the assignment to the personal interests of the students.

Students should use the information from the chart in Activity 3: Planning for Livestock, and other information from Section 2 to help them answer questions 2 to 5.

2. Choose a type of animal to raise. Explain your choice in terms of the ability of the land to support this animal. (2)

Students should describe whether they will grow feed, buy feed, or allow the animals to graze.

3. Determine the following:

- a. the land required per animal for grazing or confinement (2)

Students may use information from the chart in Activity 3: Planning for Livestock. See the information beside the subheading "How much space do they need?" under the heading "Important Things to Consider."

- b. the feed required per animal (2)

Students may use the same chart as in question 3.a. See the information beside the subheading "How much do they eat?" under the heading "Important Things to Consider."

4. Choose a scale of operations. How many animals will you raise? Explain. (2)

Students may use information from the chart in Activity 3: Planning for Livestock. See the information beside the subheading "How much space do they need?"

Students can determine the maximum number of animals that can be raised on their land by dividing the total amount of land available (less any for cultivation) by the amount of grazing land required per animal.

Example: A cow and calf require from one to three hectares of tame pasture. Using this formula, a 256-hectare farm will support between 85 and 256 cow/calf pairs.

5. Describe any changes you would make to the farm that would help you raise your animals. (3)

Answers will vary. They should include ways to improve animal housing, fencing, or feeding systems, and the installation of new equipment.

6. Describe two methods you can use to improve the quality of the animals in your herd. (2)

Crossbreeding and culling are two ways to improve the quality of your herd.

Part B

Note: Both Part A and Part B must be completed for Assignment 2.

Identify the five groups of essential nutrients (excluding water) required by a ruminant animal. Explain the importance of each nutrient to the health of the animal. (10)

Proteins – growth, reproduction, milk production

Carbohydrates – energy for heat, work, maintenance and repair

Roughage (fibre) – energy (for ruminant animals)

Minerals – regulate tissue formation and cell processes

Vitamins – keep the animal healthy by regulating tissue formation and cell processes

Student Animal Project

This is a good time for students to start an animal project. They should turn to Section 5: An Animal Project and select a project that interests them. Some guidance and help will be required in the activities related to the project. It is recommended that the learning facilitator preview the information in Section 5 in order to better assist the student. The remaining sections of this module can be completed concurrently with their project.

Note: Section 5: An Animal Project is to be done only by those students who have already completed Agriculture: Land and Life Year One. Students who have started directly into the Year Two program without doing the Year One program of Agriculture: Land and Life do not need to do Section 5. They should continue now with Section 3.

Section 3: On the Farm

This section gives students who do not live on a farm exposure to several types of farm operations. For people who live on farms, it is an opportunity to analyse their own surroundings and make comparisons with other types of farming and livestock production.

Before students get into the actual activities for this section, they are asked to think of some objectives that they think farmers and ranchers might have about managing livestock operations.

Although there are many types of livestock operations, farmers and ranchers have some common objectives:

- They want to produce a healthy product that satisfies consumer demand.
- They want to make a profit from their investments.
- They want their farm to be a successful business.

Can you think of any other objectives that farmers and ranchers might have?

Answers will vary. Provide appropriate feedback. Sample answers follow:

- *increasing product quality*
- *increasing operating efficiency*
- *reducing costs*

Students should be encouraged to contact farmers or ranchers to discuss the objectives of their specific livestock operations.

Section 3: Activity 1

The following time line is a summary of what happens during the year on a beef cow and calf operation:

- | | |
|--|-------------|
| • winter feeding on hay, silage, and milled grain | – November |
| | – December |
| | – January |
| | – February |
| • calving | – March |
| | – April |
| • begin summer grazing | – May |
| • branding (also castration, vaccination, and dehorning) | – June |
| • breeding of one-year-old heifers | – July |
| • breeding of cows | – August |
| • haying | – September |
| • harvest | – October |
| • weaning of calves from cows | – November |
| • preconditioning of calves | – December |
| • separate bulls from cows | |
| • steers and heifers to feedlot | |
| • culled cattle for slaughter | |
| • begin winter feeding | |

1. With the aid of the previous chart, write a story about a steer or a replacement heifer from its birth. Include a description of the main people, animals, and events in its life.

Answers will vary. Use the previous time line to help verify the sequence of events when you check and discuss student compositions.

2. Make a time line in the following space to show the events in lamb production over the course of a year.

- *breeding*
 - *August*
 - *September*
 - *October*
 - *November*
 - *December*
- *lambling*
 - *January*
- *tails docked*
 - *February*
 - *March*
 - *April*
- *lambs to market*
 - *May*
- *shearing sheep*

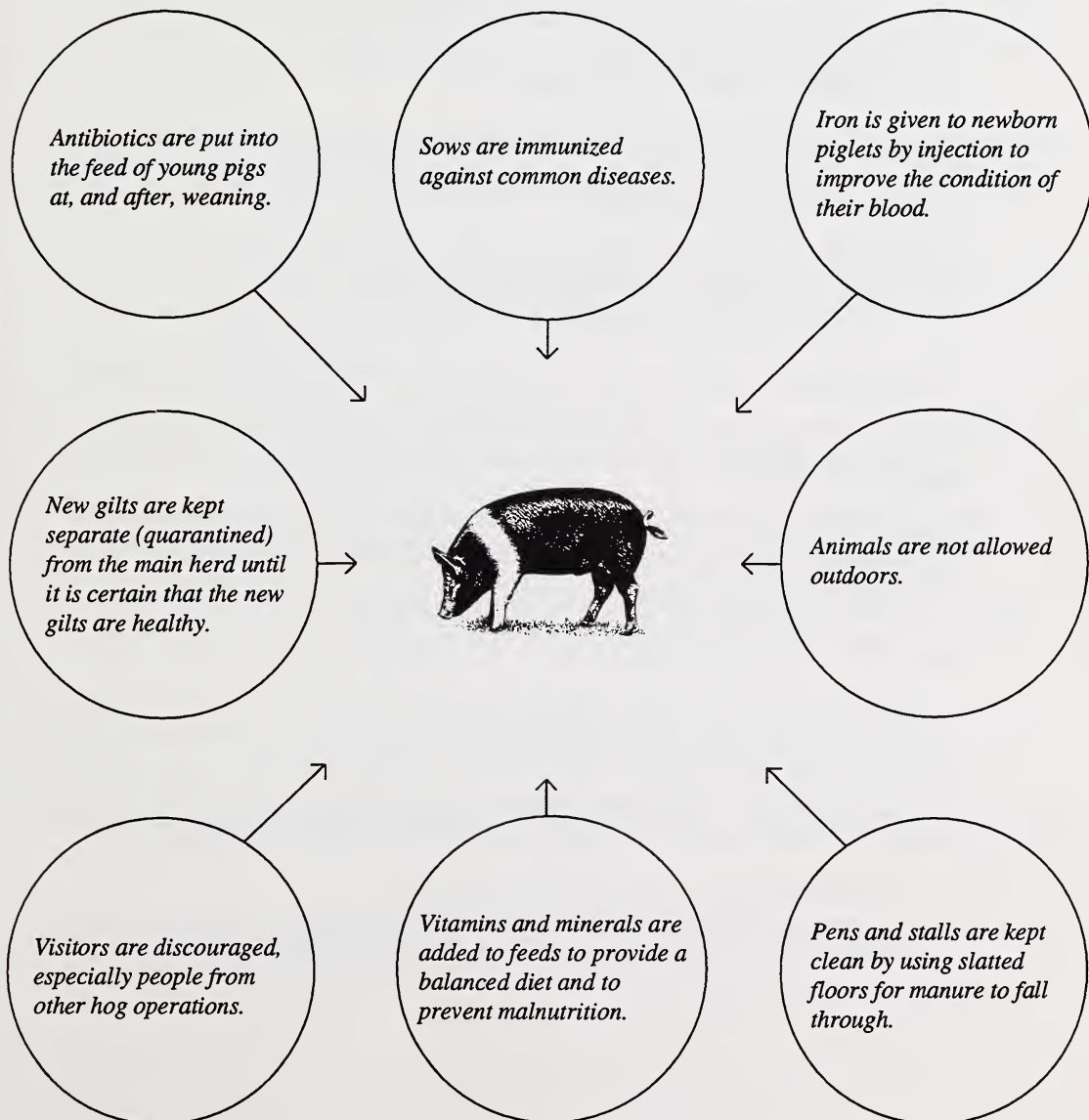
This time line is a chart of a season of lamb production on the Hughes' ranch. Other operators may schedule breeding and lambing at different times of the year. Check student charts for the length of time between the five events.

Section 3: Activity 2

1. What method of feeding sows appeals to you? Why?

Answers will vary. Discuss answers with the students.

2. In the empty balloons that follow write all of the things that a hog farmer does to ensure the health of his animals. Include things dealing with feeding, environment, and immunization.



Section 3: Activity 3

If students plan to tour a farm that they do not live on, it is recommended that the learning facilitator, parent, guardian, or other responsible adult accompany them on the trip.

1. Identify farm procedures which are involved in

- a. the production of new animals
- b. the production of animal feed
- c. the finishing of animals for slaughter

Answers for a. to c. will vary. Look for completeness and responses that are on the topic.

2. Identify the methods that are used to

- a. improve the quality of the livestock
- b. improve the growth rate of young and older animals
- c. guarantee the health of the animals

Answers for a. to c. will vary. Look for completeness and responses that are on the topic.

Section 3: Activity 4

Students are asked to complete two of the following three parts of Activity 4.

Part 1

Part 1 looks at the issue of factory farming. An example regarding the chicken industry is described in the Student Module Booklet but the questions raised can also apply to other livestock operations. Efficient operations are important but so is the welfare of the animals. In examining the issue of factory farming, students are asked to consider such items as

- Is this farming or a type of food manufacturing?
- Can farmers use confinement-rearing methods humanely?
- How far would farmers be prepared to go to have an efficient livestock operation?

In the following space include your answers to the previous questions as you discuss the issue of “factory farming.” State how far you would be prepared to go in order to have an efficient livestock operation.

Students are to discuss their answers with the learning facilitator.

Answers will vary. This is a controversial issue with no precise answers. Perhaps the best answer to the issue of factory farming is that farmers who care about their animals should treat them in as humane a manner as the situation will allow. For example, lighting and temperature are adjusted in confinement areas to calm the animals, the animals should not be frightened unnecessarily. The example regarding the chicken industry that was described in the Student Module Booklet indicated that chickens that live in battery cages can die of heart failure if they are overstimulated.

Although confinement is not normal, it cannot be considered cruel if proper consideration is given for animal welfare. Researchers are investigating ways to relieve psychological stress among animals such as that indicated by feather picking and cannibalism among chickens raised in battery cages.

These factory farming methods have been adopted to help farmers become more efficient food producers. There is, however, a human factor which sets limits on how far this process can go: this is farming. There are no such restrictions in a factory.

Part 2

Growth in humans and animals is triggered by hormones produced in the body. Scientists have known for some time that faster growth is the result of increased hormone production.

Some livestock producers now use this principle to their advantage. By stimulating hormone production, a higher rate of growth can be achieved.

This hormone-implanting method has been approved by Health and Welfare Canada, the World Health Organization, and the United States Food and Drug Administration. In spite of this the method does not appeal to consumers. Why is this so? What should beef producers do?

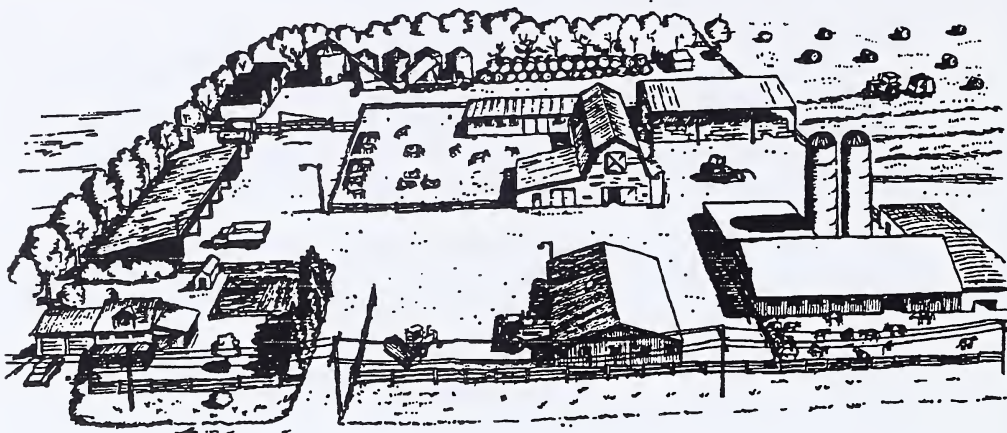
Write your answer here. Include additional information from library research on this topic if you wish.

Consumers resent this hormone-implanting method mainly due to a misunderstanding. This method is an artificial stimulation of a natural growth process. There is also a trend among consumers for “natural” foods.

The only solution for livestock producers is to ensure that guidelines for use are followed, and that the public is well informed about its use.

Part 3

Examine the following farm graphic. Find and (in the space below the graphic) name the machines that help livestock producers. Remember that many machines are small and can be found inside buildings.



The following are a few machines that students may have identified:

- *loaders for moving bales or manure piles, and mixing feeds*
- *tractors for pulling farm machinery such as tillage equipment, balers, sprayers, and manure spreaders*
- *augers for moving grain and prepared feeds*
- *compressors for pneumatic grain-moving systems*
- *computers for bookkeeping and programmed feeding systems*
- *feed mills for grinding and crushing feeds*
- *electric motors for fans, pumps, and compressors*

Section 3: Activity 5

Many people help to produce meat from livestock. On the line beneath each illustration, name the person or persons pictured.

1. *veterinarian*
2. *auctioneer*
3. *truck driver*
4. *banker*

5. *railroader*
 6. *meat packer or grocery store personnel*
 7. *restaurant owner*
 8. *farm equipment dealer*
 9. *farmer or rancher*
 10. *researcher*
 11. *construction worker*
 12. *feedlot operator*
 13. *butcher*
14. Place each person or persons named in the previous illustrations into one or more of the following categories.

Producer *farmer, rancher, feedlot operator*

Supplier *farm equipment dealer*

Services *veterinarian, researcher, truck driver, railroader, auctioneer, banker, construction worker*

Processor *meat packer, butcher*

Sales *grocery store personnel, restaurant owner*

Section 3: Follow-Up Activities

Extra Help

Students are to use the words given in a word list in the Student Module Booklet to fill in the blank spaces.

The first milk that an animal receives is called *colostrum*. Preparing a calf for life in a feedlot is called *preconditioning*. This reduces losses from *stress* on the animal caused by the move to the feedlot. The feeding of a weaned animal to market weight is called *finishing*.

Giving birth to a litter of piglets is called *farrowing*. The mother pig is called a *sow* and the father is the *boar*.

Because so many animals live in such a small space, hog farmers must take care to prevent *diseases*. New animals are *quarantined* before they are allowed to join the main herd. Sows are *immunized* against some common diseases. *Antibiotics* are added to feeds given to piglets and young pigs.

Indoor confinement also helps to prevent disease, but it creates *social problems* for the animals. *Computerized feeding systems* have been used to allow indoor animals more movement and a normal social atmosphere.

Today's livestock producers have become more efficient by using such things as *confinement rearing*, *growth hormones*, and modern *machinery*.

Many people are involved in the production of livestock and meat. Farmers are the *producers* of livestock. They rely on people such as farm equipment dealers and veterinarians for *supplies* and *services*. Livestock is *processed* into different meats and animal by-products. Still other people *market* these products to you.

Enrichment

Students are encouraged to complete two of the following three activities.

Enrichment A

1. Suppose you live on an acreage with four hectares of pasture. Land in the area is rated at 0.5 hectares per AUM.

- a. How long can you graze one horse on the land before it is overgrazed?

0.5 hectares of the acreage yields 1 AUM. So four hectares will yield

$$\frac{4 \text{ hectares}}{0.5 \text{ hectares / AUM}} = 8 \text{ AUM of feed}$$

You could graze your horse on four hectares of pasture for eight months.

- b. If you purchase two tonnes of hay, how long will this feed your horse? (Remember that 1 AUM = 11.8 kg/day)

$$\text{The feed would last } \frac{2000 \text{ kg}}{11.8 \text{ kg / day}} = 169 \text{ days.}$$

2. Farmer Jones is concerned that deer are eating too much of the native grassland pasture. A herd of 20 animals has been around most of the month. This land is rated at two hectares per AUM.

- a. How many cattle could be fed on the grass that is being eaten by the deer?

*Five deer eat one AUM
or twenty deer eat four AUM,
but four cattle eat four AUM as well.*

Therefore, four cattle could be fed on the same grass.

- b. How much of this land is used to support the deer?

Each AUM requires two hectares.

Four AUM requires eight hectares.

The deer would require eight hectares for grazing each month.

- c. Should Farmer Jones be concerned? Explain.

Farmer Jones may be concerned, particularly if the deer stay all summer! On the other hand, there may be a feeling of responsibility to provide a wildlife habitat. The deer can be controlled by hunters if they become too numerous.

3. Martha lives on a quarter-section of land west of Red Deer, which includes 64 hectares of pasture. Similar land in the area is rated at 0.5 hectares per AUM.

How many sheep (ewes) could be grazed on this land over six months of summer?

$$\begin{aligned} \text{Total amount of forage} &= \frac{64 \text{ hectares}}{0.5 \text{ hectares / AUM}} \\ &= 128 \text{ AUM} \end{aligned}$$

*If five ewes require 1 AUM,
total ewes = 5×128 or 640 ewes for one month.*

$$\begin{aligned} \text{Since the ewes will be grazing over six months, the actual number of ewes} &= \frac{640}{6} \\ &= 107 \text{ ewes.} \end{aligned}$$

Enrichment B

The feedlot finishing of cattle is a high-risk business. It takes a lot of money to buy feeder cattle and feed. The prices of feed, feeder cattle, and finished cattle are hard to predict. Losses from disease, injury, and bloat can be serious.

An owner often asks: "Will I make any money?"

In this activity students will ask the same question. Because this business is a bit of a gamble, they will use dice to determine costs and prices.

The Game

With a herd of 100 feeder cattle (average weigh 200 kg) you will try to make money by feeding them to the market weight of 450 kg.

Note: Students will pick their own solutions by rolling the dice. The sample solution presented here has assumed the mean values for all variables.

Step 1: What are your replacement costs?

Roll the die to find the cost of each steer and heifer. Then find the average cost for the herd, assuming there are equal numbers of steers and heifers.

For this sample solution assume an average replacement cost of \$505.

Step 2: What are your feed costs?

Roll the die to determine your feed prices. When you have determined the price, enter it into the table below Cost of feed in \$ per tonne. Then calculate the Cost of feed per head (\$) and Total feed costs per head using the table.

Based on average feed costs, the Total feed costs per head will be \$214.71. This amount will be used for this sample solution.

Step 3: What are your stock losses?

For this sample solution, the stock loss is assumed to be 2%, or two animals out of 100.

Step 4: Other things that cost

We are assuming an average other cost of \$50 per head for this step.

Step 5: What is the average final weight?

For this step we are assuming an average final weight of 475 kg.

Step 6: If the price is right . . .

For this step we assume an average price of \$185. This will make the average value for a finished animal

$$\text{Average value} = \frac{\text{Average Price / kg} \times \text{Average Final Weight}}{100}$$

$$\frac{185.00 / \text{kg} \times 475 \text{ kg}}{100} = \$878.75$$

Step 7: Let's see how well you have done!

Use the figures you have determined in Step 1 to Step 6

Costs

average replacement cost per head	\$ 505.00
+ feed costs per head	\$ 214.71
+ other costs per head	50.00
	=====
= average cost per head	\$ 769.71
× number of cattle at start	× 100
	=====
= TOTAL COSTS	\$ 76 971.00
	=====

Income

original cattle	100
– losses	– 2
	=====
= remaining cattle	98
× average value	\$ 878.75
	=====
= TOTAL INCOME	\$ 86 117.50
	=====

Your profit equals total income – total costs.

PROFIT =

In this example PROFIT = \$86 117.50 – \$76 971.00 = \$9146.50.

Some money was made using the average values for all variables in this sample solution. Try the same game using several students. Who will make the most money?

Be sure to check student calculations. Depending on the rolls of the dice, some students will make money while others will lose.

It may be appropriate to arrange for a feedlot operator to visit and discuss the feedlot business with the students. A comparison between the students' question results and the feedlot operation would be interesting.

Enrichment C

Now it is your turn. Design a brand to identify your cattle. A brand is a part of the family history of many Alberta ranches.

Answers will vary. Show an interest in students' designs. Check to see that the rules listed in the Student Module Booklet are followed.

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Section 3 Assignment

1. Select two types of livestock production. Use the examples presented in Section 3, or compare one of these examples with a farm that you have toured on your own. Compare these two farms in terms of the following:

Note: The following answers describe the farms toured in this section. Student answers may be different if they wish to compare other farms that they have toured on their own.

- a. type of operation (2)

Cow/calf – calf production

Hog farm – production of piglets for sale and/or the finishing of animals for slaughter

- b. number of animals produced (2)

Cow/calf – one calf per cow each year

Hog farm – 18 piglets per sow (or about 3600 piglets on this farm)

- c. type and amount of land required (2)

Cow/calf – seven sections of land for 300 head

Hog farm – quarter-section for 200 sows (plus two sections of rented land for additional feed cultivation)

- d. structures and animal housing (2)

Cow/calf – fences, wind protection, feed troughs

Hog farm – indoor housing, feeding, and waste management systems

- e. machinery used (2)

Cow/calf – a minimum of farm equipment for hay and forage production

Hog farm – mechanical feeding systems, manure spreader, equipment for grain farming

- f. feed requirements (4)

Cow/calf – forages

Hog farm – grains

- g. procedures to ensure animal health (4)

Cow/calf – assist in calving, balanced nutrition, preconditioning

Hog farm – farrowing pens, immunization, antibiotics, quarantine, balanced nutrition

2. Plan a typical day on a farm of your choice. In a few paragraphs describe the important things that must be done to ensure the animals are healthy and well fed. (8)

Answers will vary but should include some of the following concepts.

Cow/calf

– herd inspection, feed mixing, feeding, vaccination and dehorning, cultivation and crop harvesting, herd management

Hog farm

– herd inspection, cleanup, feed mixing, feeding, immunization, cultivation, herd management, waste management

Section 4: Making the Most of Meat

This section traces the path of meat from farm to table and examines the important steps along the way. In the process, students will gain an appreciation of the contributions that livestock make to their personal, economic, and social well-being.

Section 4: Activity 1

1. Compare the three marketing systems using the following table.

	Private Sales or Public Auction	Producer-Owned Cooperatives	Marketing Board
Which system will show the most or least variation in prices?	<i>Prices will vary continuously.</i>	<i>Prices will vary but producers will receive the average daily price.</i>	<i>Prices are fixed within certain limits which may vary over longer periods of time.</i>
Which system allows producers to search for the highest price?	<i>In the short term, the highest prices will be paid in this system.</i>	<i>Some producers benefit more than do others from this system. Not all producers are close to markets.</i>	<i>Lower but steadier prices will be found in this system.</i>
Do any of these methods control prices?	<i>no</i>	<i>no</i>	<i>no</i>
Do any of these methods control the amount of supply?	<i>no</i>	<i>no</i>	<i>Yes. Supply is controlled by quotas to an oversupply which would make prices drop.</i>
Rate the amount of risk in each system from least to most.	<i>There is a high risk of falling prices.</i>	<i>There is a moderate risk of a long-term price drop.</i>	<i>There is a low risk of loss due to falling prices.</i>

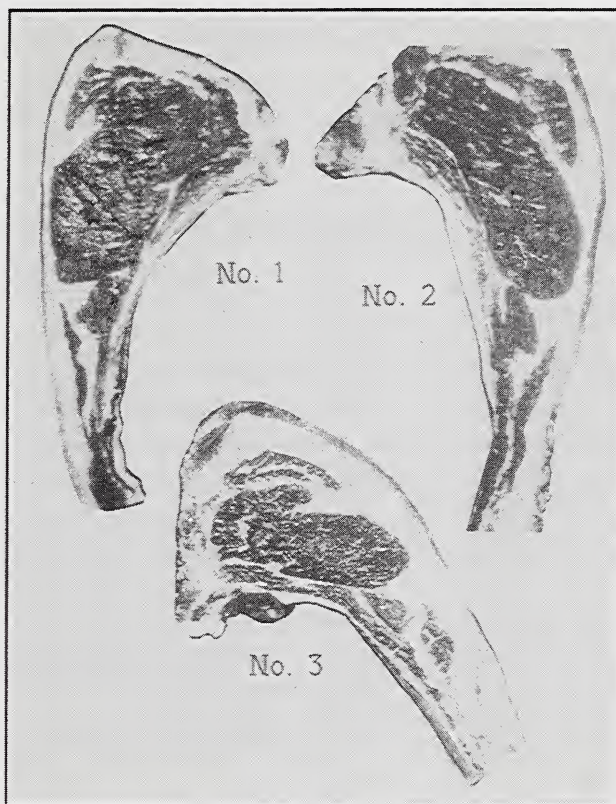
2. Which system would you prefer? Explain the reasons for your answer in the space below.

Answers will vary. Discuss student ideas.

Do not expect a detailed answer. As consumers, many people would favour a system such as a public auction that would produce bargains when supplies are high. Other people would prefer a system that produces steady prices.

Section 4: Activity 2

Based on the grading system for beef, identify the following steaks as grade A1, B1, or B4. Explain the reasons for your choices.



No 1: Grade *A1*

Reason: *This has a fine texture, and a reasonable fat cover. It is also well marbled.*

No 2: Grade *B1*

Reason: *This has little fat but no marbling, and a coarse texture.*

No 3: Grade *B4*

Reason: *This cut has too much fat.*

Section 4: Activity 3

1. Turn to the diagrams of meat carcasses at the end of the Appendix.

How many prime cuts are shown for each animal?

Beef 7

Pork 4

Veal 4

Lamb 4

2. Why are there more prime cuts in large animals?

Prime cuts reduce the weight that must be handled. Smaller animals need fewer prime cuts.

3. Trace the path of the following products on the flow chart, located on the following page. Use a different colour for each product:

- a steak dinner in a hotel restaurant
- bulk boxed ground beef for the school picnic
- locally made farmers' sausage
- a pork chop at a supermarket
- a leather handbag

Answers will vary.

Check student answers for a logical pathway. Final cutting is most often done at a local market, supermarket, or restaurant. A leather handbag would be manufactured from hide which is a by-product of Meat Sector Processing.

4. Test yourself by filling in the following chart.

Place a ✓ in the box below the type of meat that would produce the cuts listed. Please note that there may be as many as four ✓'s for each cut of meat.

	Beef	Pork	Lamb	Veal
cutlets		✓		✓
round steak	✓			
spareribs	✓	✓		
short ribs	✓			
stew meat	✓	✓	✓	✓
ground meat	✓	✓	✓	✓
sausage	✓	✓	✓	✓
bacon		✓		
prime rib roast	✓			
kidney	✓	✓	✓	✓
ham		✓		
leg roast		✓	✓	✓
sirloin steak	✓			✓
chops		✓	✓	
tenderloin	✓	✓		✓
rolled roast	✓	✓	✓	✓
hocks		✓		

The answers are also included in the Appendix of the Student Module Booklet.

5. Are there some cuts not mentioned? List five other meat cuts and the type of animals that they come from.

Students can check their own answers to question 5 by using information given in the Meat Cuts section at the end of the Appendix in the Student Module Booklet.

6. Under the following headings, write down the main by-products of these items, and some of the things they are used for.

Bones/Hooves

*gelatin
ice cream
glue
marshmallows*

Hide/Hair

*leather
wallets
shoes
purses*

Glands

pharmaceuticals

Tallow (fat)

*glycerin
lipstick
soap
toothpaste
explosives*

A list of some pharmaceuticals made from cattle is included in Enrichment B.

Section 4: Activity 4

1. Visit your local grocery store and record the Best Before dates for the following products.

Note: Look for labels that say vacuum packed and underline them in your table.

Today's Date is _____

	Best Before	Store Shelf Life	Normal Shelf Life
steak			3 – 4 days
ground beef			2 days
pork chop			3 – 4 days
fresh pork sausage			2 days
luncheon meats			4 days

Circle any meats that seem to be outdated. Then read on to find out if this is okay.

Answers will vary. Researching shelf life may produce some surprises. For example, vacuum-packaging extends the shelf life of meats. Preservatives may also be used for prepared luncheon meats.

2. The following table lists the common methods used to preserve meats. Use what you have just learned about enzymes, oxygen, and bacteria to match each lettered method with the best description on the right side of the table. Match letters to the corresponding definitions; place letters on the lines to the left of the definitions.

Note: If you need more information, you can find it in most encyclopedias under the topic "Food Processing."

METHODS TO PRESERVE MEATS		
a. vacuum packaging	<u>e</u>	uses very cold temperatures to slow the action of enzymes and oxygen, and the growth of bacteria
b. cellophane wrap	<u>b</u>	reduces the exposure to oxygen to prevent discolouration
c. canning	<u>f</u>	removes moisture to prevent the growth of bacteria (but does not kill bacteria)
d. refrigeration	<u>d</u>	uses lower temperatures to slow the growth of bacteria and molds
e. freezing	<u>c</u>	kills most bacteria by cooking, and prevents the growth of bacteria by removing the oxygen supply
f. drying	<u>a</u>	prevents growth by removing oxygen and replacing it with a gas that bacteria do not like
g. smoking	<u>l</u>	kills bacteria with penetrating rays of energy
h. pickling	<u>g</u>	adds a pleasing flavour to the meat, and creates substances in the meat that prevent the growth of bacteria
i. adding preservatives	<u>i</u>	substances are added to precooked meats to slow the growth of bacteria and to reduce enzyme activity
j. pasteurization	<u>h</u>	creates a very acidic environment that bacteria do not like
k. cooking	<u>j</u>	kills most bacteria in milk with low heat
l. irradiation	<u>k</u>	kills bacteria with high heat

Section 4: Activity 5

1. Describe package features that would appeal to the meat consumer.

Package features should be visible, clean, and informative. As well, the price, weight, and grade should be clearly marked.

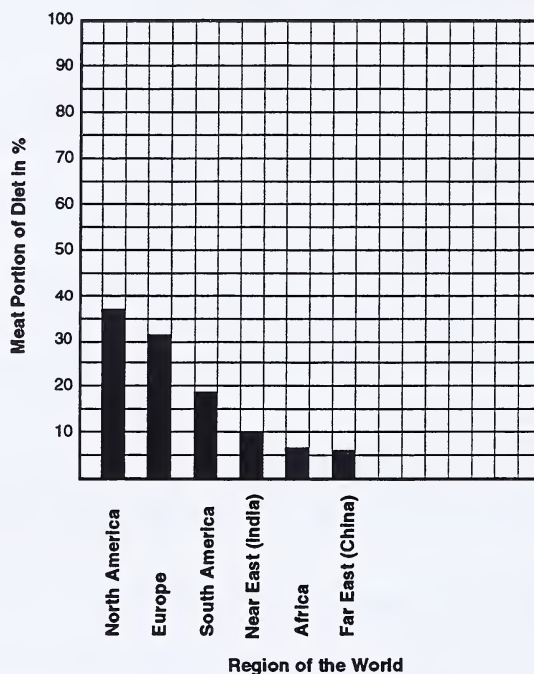
- Outline the information found on the package.

Students should identify the price per weight, the weight, the type of cut, and the best before date.

Section 4: Activity 6

- Draw a bar graph using the values just given. Be sure to include the appropriate labels to complete the graph.

PROPORTION OF MEAT IN DIETS AROUND THE WORLD
(as % of total calorie intake)



Answers should reflect the outlined percentages.

- Some people argue that meat is a food people don't need. They say meat production wastes farmland.

Other people maintain that meat is a wholesome food that all should have. They say meat is produced on land that is not suitable for conventional farming.

Who is correct? Write your opinion. Give reasons for your opinion from information collected in this module or from elsewhere.

Answers will vary but should include ideas from this module.

- Now read “Arguments For and Against Meat” in the Appendix. You may also wish to gather further information on the topic from other reference materials. Who do you think is right now? Has the additional reading caused you to change your mind? If so, why?

Answers will vary. For reference, the pro and con arguments are reprinted here from the Appendix of the Student Module Booklet.

Pro Meat Arguments

Meat is a convenient and nutritious food rich in proteins, minerals, and energy. Meat is a source of complete proteins, and it adds variety to people’s diets. Meat animals provide humans with many valuable by-products. Many people find employment in meat-related industries.

Meats are mainly produced by ruminant animals that can survive on nondigestible vegetable fibres. As a result meat animals make use of all the plant, rather than just the seed portion. Ruminants can obtain nutrients from land that is not suited for conventional farming.

Meat animals can eat surplus grain; it is difficult to sell Canada’s total grain harvest in most years. Livestock also provide an alternative source of income for farmers. Unlike grain crops, there are no government subsidies for livestock production.

Con Meat Arguments

Meat is an expensive food to produce. One kilogram of meat requires almost 10 kg of feed to produce it. Much of this feed comes from cultivated forages grown on land that could produce grain or vegetable crops for humans. In some parts of the world large areas of farmland are held by individuals and used for the production of meat for export. This lessens the amount of land available to produce food for local people.

Many meat animals are raised under conditions that cause extreme physical and mental hardship. Confinement rearing of poultry, hogs, and calves is done for efficient production at a cost to animal welfare.

Meats are rich in fats, which are substances that have been linked to heart disease and intestinal cancer. The average North American consumes more meat than is needed for nutrition alone.

- What is Canada’s most popular meat?

Beef is Canada’s most popular meat.

- Chicken consumption per person in Canada increased from 17 kg per year in 1973 to 20 kg per year in 1986, while beef consumption decreased. Much of this change has to do with the price of chicken compared to red meat. Try to explain why chicken is becoming so popular.

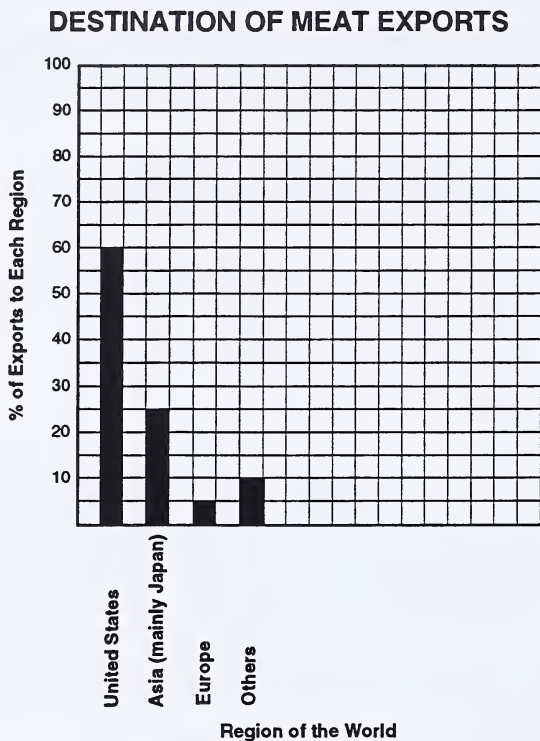
The store prices of chicken are lower than most meat cuts. There is also a perception among many consumers that white meats (such as chicken) have less fat and less cholesterol than red meats (such as beef).

6. What are the advantages Alberta has over other parts of Canada when it comes to meat production?

Alberta has an abundance of grazing land and a good supply of low-cost feed.

Alberta normally has enough water, but if there is a weak link in the chain, this is it!

7. Use these values to construct a bar graph to show where Canada's meat exports go. Be sure to include necessary labels.



Answers should reflect the outlined percentages.

Section 4: Follow-Up Activities

Extra Help

As a review of this section you are asked to write an autobiography of one of the following: a pork chop, a hamburger pattie, a beef steak, or a chicken leg. Include a description of all the things that happen to you as you go from farm to table.

Answers to this activity will vary. To evaluate student answers, use the chart in the Student Module Booklet, which shows the path followed by meat from farm to table and the major stops along the way.

Enrichment

Enrichment A

Consider the following dilemma:

Bison in Wood Buffalo National Park in Northern Alberta are infected with tuberculosis. As human settlement comes closer to the park, Agriculture Canada presses for a total slaughter of all bison to protect cattle from this disease; Agriculture Canada says there is no other way to eliminate the disease from this herd.

Which of the following should the government do?

- Slaughter the herd and repopulate the area with “clean” buffalo.
- Limit settlement in the area and isolate the buffalo herd until a better solution can be found.

What do you think? Write your answer here.

Answers will vary. In all cases, however, it is hoped that students will see the value in protecting the livestock industry.

Students should discuss their answer with the learning facilitator or another interested adult.

Enrichment B

See for Yourself: Use the information presented to make a list of some of the illnesses and health needs that can be helped with medications made from animals.

Answers will vary. Some of the illnesses and health needs that can be helped with medications made from animals include the following:

- *sugar diabetes*
- *burns*
- *frostbite*
- *blood clotting*
- *thyroid problems*
- *bleeding (no clotting agent)*
- *allergies (hay fever and asthma)*
- *anemia (thin blood)*
- *leukemia*
- *milk digestion*
- *bases for skin creams and nonprescription medications*

Enrichment C

1. Why would people in other countries want to buy the semen or embryos of Canadian livestock?
Why would they want to purchase livestock from Canada?

People in other countries want productive herds, but do not have the long history of breed development that is available in Canada and other countries. Importing the semen and embryos of Canadian livestock are ways that productive herds can be quickly achieved.

2. Why is the prevention of disease among Canadian livestock so important?

Canada's reputation as a reliable source of quality livestock depends on a disease-free product – this is also a factor in meat exports.

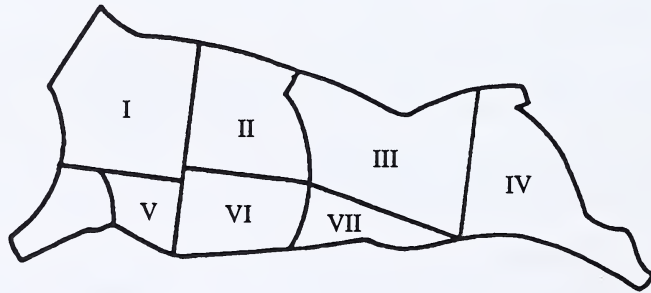
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Section 4 Assignment

Students are to complete both Part A and Part B of this assignment.

Part A

Use the following graphic to identify and name the prime cuts of a meat animal from I to VII. Give at least one example of a meat cut from each prime cut. (14)



I *Chuck*

Cuts: *chuck steak/roast*
cross rib steak/roast

II *Rib*

Cuts: *rib eye steak*
short ribs

III Loin

Cuts: *tenderloin*
T-bone steak

IV Hip

Cuts: *Rump roast*
Round steak
Sirloin tip

V Brisket

Cuts: *brisket*
shank

VI Plate

Cuts: *plate*
short ribs

VII Flank

Cuts: *flank*

Part B

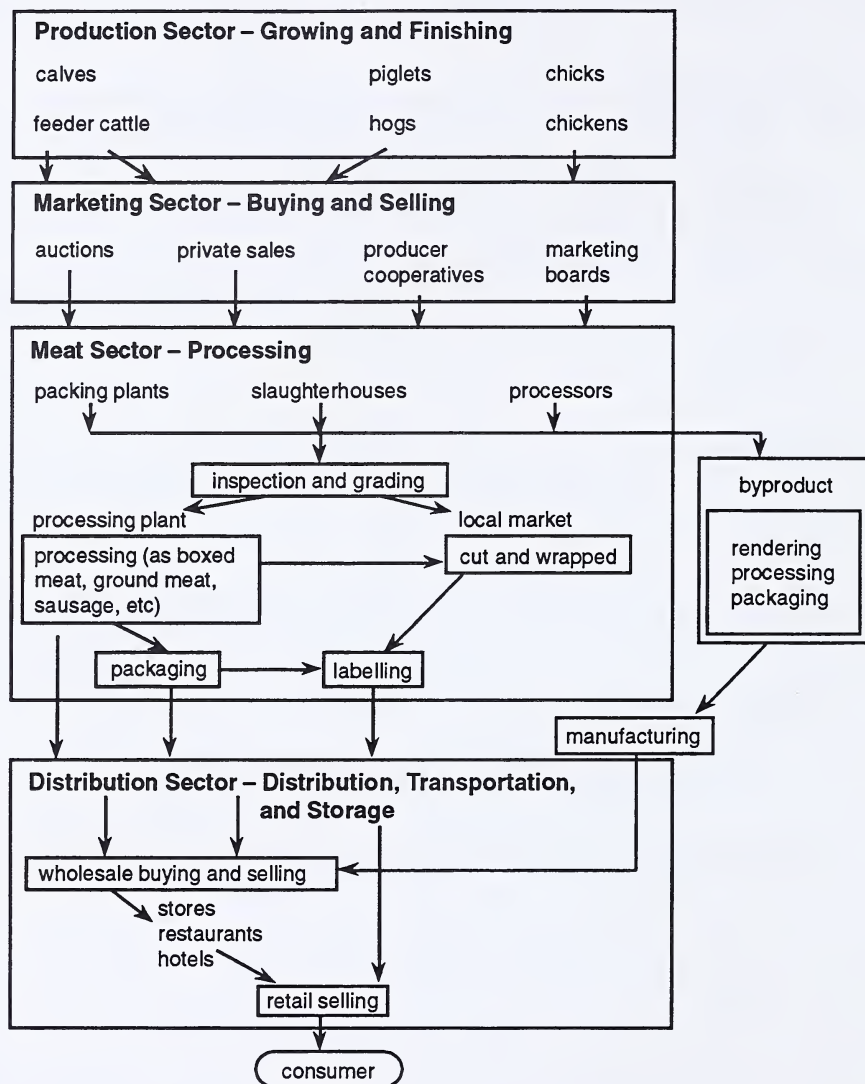
Choose a meat product. Write a story that tells the history of this product as it travels from the farm to a consumer.

Include a description of

- the important steps along the way
- the job of at least one person who is employed at each stage

You should include five important steps. (10)

The flow chart included with Activity 3 and Extra Help in the Student Module Booklet can serve as a marking guide. It is reproduced here for your reference.



A final grading for Module 3 can be determined at this point. The assignments for Section 5: An Animal Project are evaluated as part of Module 4.

Section 5: An Animal Project

Student projects are included in the Agriculture: Land and Life Year Two course to give students a chance to pursue personal interests. A choice of animal projects has been included to enable students to learn more about animals and livestock. For this project students can raise a farm animal or they may use the project as an opportunity to test ideas and answer questions about livestock or about how farming can affect wildlife habitats. Whatever the reason, a key part of the project experience should be enjoyment. Students should choose something that they would like to do.

Note: Section 5: An Animal Project is to be done only by those students who have previously completed Agriculture: Land and Life Year One. If this course is the student's first enrolment in the Agriculture: Land and Life program, then the project is to be omitted – Part A: What Is Agriculture? in Module 4 will need to be done instead.

The type of project that students select will vary. As a result not all of the activities in Section 5 are critical to the completion of any one individual project. The activities in Section 5 are included to assist students with the planning and completing of assignments regarding the animal project in the Module 4 Assignment Booklet.

Section 5: Activity 1

Students should use this activity to select an animal project and set reasonable objectives for the project.

1. What type of project would you like to do? Write your thoughts here.

Answers to this question will vary. If students are not able to raise an animal in their present situation, they can research a particular animal.

2. Write down your choice of animal.

Answers will vary. At this stage students are only in the preliminary planning stages. Later, when students have made a decision about what type of project to do, they will check and discuss their plans with the learning facilitator.

3. Now it is time to make decisions. Have you read all of the project suggestions? Which project and which animal would you like to work on?

Before students begin actual work on their projects they should become familiar with the parts of this project. The instructions for various projects are given in the Student Module Booklet, but the assignments that students need to do for the animal project are located in Part B of the Module 4 Assignment Booklet. This allows students time to work on their projects while continuing to work on other modules.

Students will read through the list of project ideas to select their project, and it is recommended that learning facilitators also read through the list to gain insights, and to ensure that choices are achievable within the scope of each project. Students have a choice of four projects:

- Project A: Animal Care
- Project B: Animal Study
- Project C: Wildlife Management
- Project D: Trapping and Conservation

After discussing plans with their learning facilitator, students will complete Project 2: Assignment 1 in Part B of their Module 4 Assignment Booklet.

5

Part B: Project 2: Assignment 1

1. Describe your animal project. (2)

- a. What animal do you plan to raise or study?

Answers will vary.

- b. Why did you select this particular animal or breed?

Answers will vary. The animal should, however, provide humans with some sort of product or service, or be a type of wildlife in a habitat that is influenced by human activity.

2. State your goals. What do you hope to achieve with this project? (3)

Answers will vary. Look for specific learning objectives.

Section 5: Activity 2

Students should use this activity to gather and organize information about their project. It is recommended that the learning facilitator also read the information listed under “Where to Look:” in the Student Module Booklet, to assist students in locating some of the reference materials. Encourage the students to use a variety of information sources.

Students will now complete Project 2: Assignment 2 in Part B of their Module 4 Assignment Booklet.

5

Part B: Project 2: Assignment 2

1. List all reference books that you plan to use in this project. Add the author, title, publisher, and date of publication. Follow with a one-line description of the content.
2. List any people or clubs that might provide you with help and information.
3. Add new sources of information to your list as you find them.

Answers for this assignment will vary. Encourage students to use a variety of sources.

Section 5: Activity 3

This activity and the assignment for this activity will help students plan each step of their project. Again it is recommended that the learning facilitator preview the information in the Student Module Booklet for this activity in order to better assist the student.

If you plan to raise an animal, answer the following questions about housing.

1. How much area is required for sleeping or grazing?

Many books will give the recommended size required for caged birds. See also Section 2: Activity 3 in the Student Module Booklet for the space required by different livestock animals.

2. What type of shelter is needed?

Many books will outline the recommended shelter needed for a variety of animals. See also Section 2: Activity 3.

3. What type of bedding should you use?

Straw or wood chips are the most common types of bedding materials.

4. What type of feeding “furniture” is needed?

Answers will vary, depending on the animal chosen for the project.

5. How will the housing be cleaned?

Answers will vary. A shovel will most likely be used.

6. Locate the specifications of a high quality commercial feed for your animal. Identify the amount of each essential nutrient listed in the chart. Include this information in your report for your animal project in the Module 4 Assignment Booklet, as well as in the following chart.

Essential Nutrients	Amounts Listed in a Commercial Feed	Alternate Sources of Essential Nutrients
proteins		
carbohydrates		
fats		
minerals		
vitamins		
roughage (fibre)		
moisture (water)		

Specifications will vary depending on the commercial feed being used for the animal that is being raised or researched for the project.

7. In the previous chart provide an alternate source for each of the essential nutrient groups using a noncommercial blended feed.

Note: Nutrients and vitamins may need to be added to some feed sources.

Answers will vary.

8. Where do you plan to obtain feed for your animal?

Answers will vary.

9. What type of habitat does your animal prefer?

Answers will vary. If the project involves the study of wild animals, the students should include biotic factors (food sources and predators) and abiotic factors (climate, landforms, and other physical features of habitat).

Students will now complete Project 2: Assignment 3 in Part B of their Module 4 Assignment Booklet.

10

Part B: Project 2: Assignment 3

Students should answer only the questions for Project A, B, C, or D, depending on the project they are doing.

Project A

1. Describe the housing for your animal. Use a diagram if you wish. (5)

Answers will vary. Award marks for a considerate design.

2. Outline where you will obtain feed for your animal. Describe the essential nutrients in its normal diet. (5)

Answers will vary. See also Section 2: "Animal Nutrition" in Activity 2 of the Module 3 Student Module Booklet. Award marks for a balanced diet.

Project B

1. Describe the normal type of housing required to raise this animal. Use a diagram if you wish. (5)

Answers will vary. Award marks for a considerate design.

2. Outline the sources of essential nutrients in a normal diet for this animal. (5)

Answers will vary. See also Section 2: "Animal Nutrition" in Activity 2 of the Module 3 Student Module Booklet. Award marks for a balanced diet.

Project C

1. Describe the ideal habitat for your animal. Use a diagram if you wish. (5)

OR

Describe a part of your farm or acreage that could be a suitable habitat for the animal you have chosen. (5)

Answers will vary. Award marks for a thorough description.

2. How will this habitat provide suitable shelter and protection from predators? (2)

Answers will vary. Award marks for a considerate response that discusses both protection and predators.

3. Describe the normal diet of your animal. How will the habitat provide all the essential nutrients that the animal requires? (3)

Answers will vary. Herbivores require wild plants, such as forages, and tender shoots from trees. Carnivores are at the top of the food chain, and will receive their nutrients from the plant eaters.

Project D

1. Outline the ideal habitat for your animal. Use a drawing or picture if you wish. (5)

OR

Draw a map of a trap line that you plan to operate. Identify and describe the habitats that are suitable for this animal. (5)

Answers will vary. Award marks for a thorough description.

2. Describe the shelter that this animal uses as a home. How does it shelter the animal and protect it from predators? (2)

Answers will vary. Award marks for a thorough description.

3. Describe the normal diet of your animal. How will the habitat provide the essential nutrients that the animal requires? (3)

Most fur-bearing animals are carnivores at the top of the food chain. They will receive their nutrients from the plant eaters that they consume.

Section 5: Activity 4

When raising an animal, people must learn to recognize signs of illness or disease. When caring for wild animals, people must recognize signs of poor health and problems with the animal's habitat.

In Activity 4 and Part B: Project 2 – Assignment 4 of the Module 4 Assignment Booklet, students will apply the information that they have gathered to

- care for an animal
- prepare a report
- examine and plan a wildlife habitat

The learning facilitator should preview the information in the Student Module Booklet for this activity to better assist students.

What is Normal? What is Not?

Here are some normal rates for various animals.

1. If you plan to raise an animal, fill in the bottom line of this chart with the normal temperature, pulse, and respiration rate for your animal.

Animal	Temperature °C (°F)	Pulse and Heart Rate (beats/min)	Respiration (breathing) Rate (breaths/min)
horse	37.7 (100.0)	30 – 34	8 – 16
cattle	38.3 (101.0)	60 – 70	10 – 30
pig	39.2 (102.5)	60 – 80	8 – 18
sheep	39.1 (102.3)	70 – 80	12 – 20
dog	38.9 (102.0)	70 – 120	10 – 30
cat	38.6 (101.5)	110 – 130	20 – 30
your animal?			

Students may need to do some research to obtain this information. Students should not attempt to take the temperature of an animal without supervision from a veterinarian or another experienced adult. A phone call to a veterinarian will also produce this information for normal animals.

2. a. List the most common diseases for your animal.
- b. What are the common symptoms of each disease?
- c. How is each disease prevented and treated?

Answers will vary. The diseases named will depend on the animal selected for the project. To check the symptoms of each disease, and how each disease is prevented and treated, the learning facilitator may need to refer to reference books on animal diseases.

The following is an incomplete list of diseases in some types of animals.

Dogs

Canine distemper

Canine hepatitis

Canine heartworm infection

Canine parvoviral infection

Cats

Feline distemper

Feline calicivirus

Feline pneumonia

Swine

Erysipelis

Transmissible gastroenteritis

Swine dysentery

Sheep

Scabies

Enterotoxemia

Ovine vibriosis

Cattle

Respiratory disease

Blackleg

Leptospirosis

Brucellosis

Horses

Equine distemper

Equine encephalomyelitis

Tetanus

3. List the common parasites that might be found on your animal.

Answers will vary. Here is an incomplete list of common animal parasites.

Flies and mosquitoes

Horse bots

Lice

Ticks

Cattle grubs

Fleas

Mites

Wool maggots

Students may visit a veterinarian to discuss animal diseases. The veterinarian may also be interested in visiting the students to talk about animal diseases, and other topics.

Students will now complete Project 2: Assignment 4 in Part B of their Module 4 Assignment Booklet.

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Part B: Project 2: Assignment 4

Students should answer only the questions for Project A, B, C, or D, depending on the project they are doing.

Project A or Project B

Describe how you (or other people) will manage the following aspects of your animal's life:

(3 marks each)

1. Your animal's normal behaviour
2. Prevention of the common diseases
3. Control of parasites
4. Cleaning (How often? What will you do with wastes?)
5. Grooming

Answers will vary for questions 1 to 5. Read "Signs of Good Health," "Preventing Disease," and "Wildlife Management" in Section 5: Activity 4 of the Module 3 Student Module Booklet.

Project C or Project D

1. Complete a wildlife survey in an area that you would like to improve. Include all of the animals that you can identify, not just the animal that is the topic of your project. If your animal lives in several separate areas, visit each area to estimate the number of wild animals at each location. Describe how you did your survey, then outline your survey results in table form on the following response page. Use the following table only as a guide. (5)

Estimated Number of Animals			
Animals	Area 1 or Day 1	Area 2 or Day 2	Area 3 or Day 3

Answers will vary. Read “Counting the Animals” in Section 5: Activity 4 of the Module 3 Student Module Booklet for general background information. A chart similar to the one shown above may contain the answer. Determine how reasonable the survey is.

2. Explain how you might improve your animal’s habitat to increase the population. Your ideas might involve improving the housing or food supply, creating nesting areas, improving protection against predators, controlling predators, and importing animals from another area, hatchery, or game ranch. (10)

Use a diagram to illustrate your plans, or include photographs of any work actually completed.

Answers will vary. Read “Improving Habitats” in Section 5: Activity 4 of the Module 3 Student Module Booklet for some general ideas.

Section 5: Activity 5

Students should read the information in the Student Module Booklet to prepare for the Activity 5 assignment. In addition, they will need to do some research. Students should now complete Project 2: Assignment 5 in Part B of their Module 4 Assignment Booklet.

10

Part B: Project 2: Assignment 5

Students should answer only the questions that apply to their project.

Project A

1. Describe how your animal will be used to provide a product or service. (2)

Answers will vary.

2. Describe any special medication, grooming, or training that is required before you can market your animal. (5)

Answers will vary.

3. Prepare a graph which compares some aspect of your animal. For example, note the weight gain or growth over a period of time, the time spent caring for the animal each week, or the amount of feed consumed over a given time. (3)

Answers will vary. Check for the appropriate demonstration of a relationship.

Project B

1. Describe how your animal will be used to provide a product or service. (5)

Answers will vary.

2. Outline how the animal will be trained, sold, and processed. (3)

Answers will vary.

3. Include a graph which compares some aspect of your data. For example, compare the percentage of your animal in the general livestock population, or the uses of the animal for different purposes. (2)

Answers will vary. Check for the appropriate demonstration of a relationship.

Project C

1. Describe how improvements in wildlife habitats can benefit people as well as animals. (2)

Habitats such as shelterbelts can also protect livestock and people. Beaver dams can act as a source of water for emergencies. Cover crops and shelterbelts can prevent erosion.

2. Investigate and report on how wildlife organizations, governments, or individuals help to manage and preserve wildlife habitats. (5)

Answers will vary. Information is available from Ducks Unlimited and Fish and Wildlife offices. These organizations promote the interests of wildlife by stressing the benefits of wildlife to landowners.

3. Include a graph which compares an aspect of your data. For example, compare the number of animals or birds counted before and after your improvements, the number of animals in different areas, or the proportion of your farm that is used for various purposes, including wildlife habitats. (3)

Answers will vary. Check for the appropriate demonstration of a relationship.

Project D

1. Describe how humane trapping methods can be used to trap your animal. (5)

Answers will vary. The emphasis in this project should be on humane methods of trapping.

2. Describe the methods used to preserve a pelt from your animal. (3)

Look for a description of skinning, forming, fleshing, and drying.

3. Include a graph which compares one aspect of your data. For example, note the number of animals harvested in Canada or Alberta over several years, or the number of trapping licences issued over several years. (2)

Answers will vary. Check for the appropriate demonstration of a relationship.

Section 5: Activity 6

Students should read the information in the Student Module Booklet for Activity 6, then complete Project 2: Assignment 6 in Part B of their Module 4 Assignment Booklet.

5

Part B: Project 2: Assignment 6

1. Evaluate the success of your project. Were your original goals achieved?

Explain why or why not. (2)

Answers will vary. Students should decide which goals were realized and identify the goals which may be achieved in the future. Finally, they should look at the goals that were not achieved. How well did they do? Have they offered an explanation if something did not go according to plan?

2. Describe a controversial issue that affects your animal. How do you feel about such things as

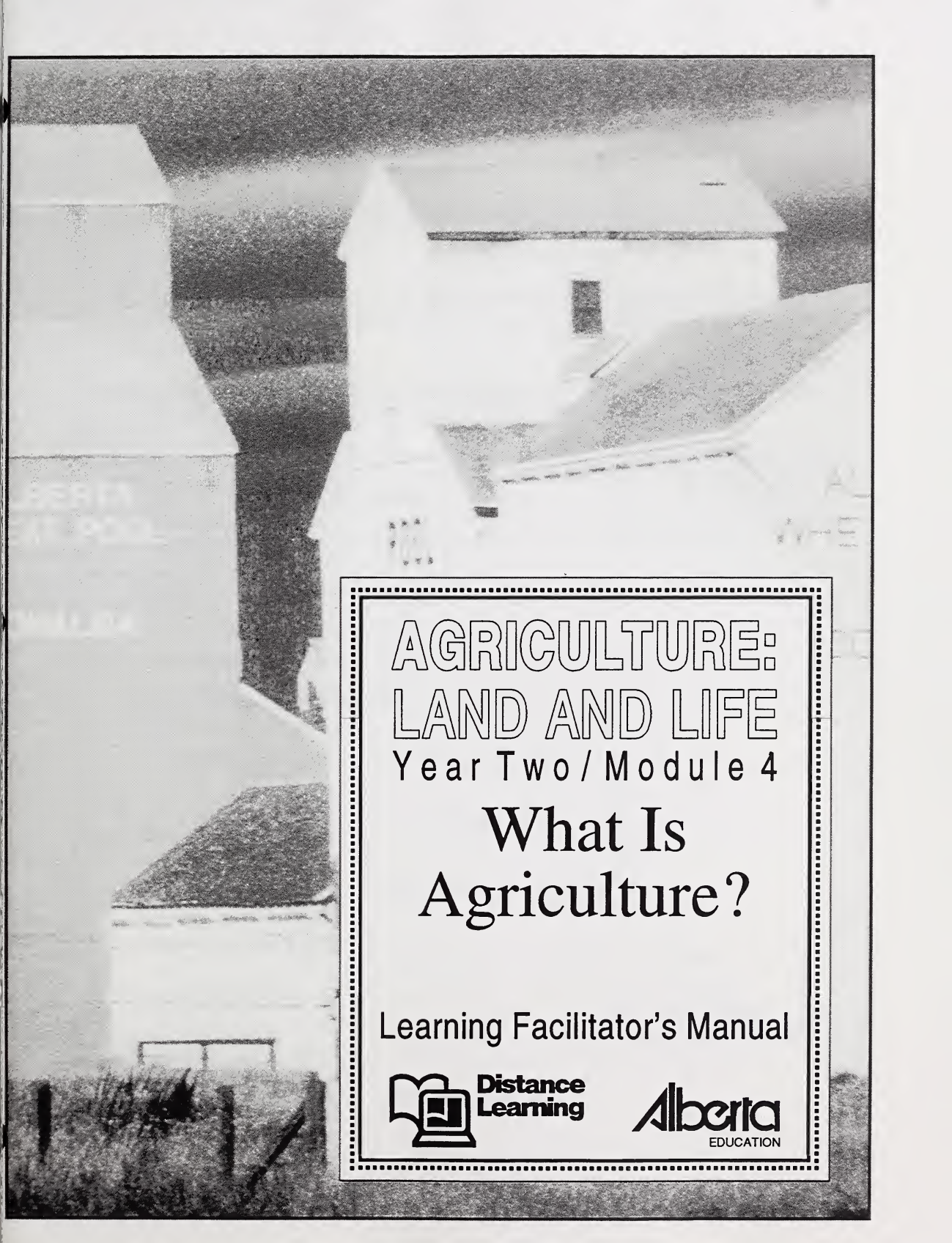
- confinement-rearing of livestock
- using animals for medical experiments
- using growth hormones to increase rates of weight gain, strength, and endurance
- game ranching – raising wild animals, such as elk, to sell to special markets
- preserving marsh wetlands for waterfowl
- a European ban on the import of fur or fur products
- dangerous dog laws
- cat bylaws (Don't let your cat outdoors without a leash!)

Write about these topics or any other issues that relate to your animal. Be sure to take a stand. Justify your opinion. (3)

Answers will vary.

If the assignments for both Project 1: A Plant Project and Project 2: An Animal Project have been corrected, a final grading for Module 4 can now be determined.

If students have completed and been assigned gradings for all four modules of this course, a final grading for Agriculture: Land and Life Year Two should now be determined.



AGRICULTURE: LAND AND LIFE

Year Two / Module 4

What Is Agriculture?

Learning Facilitator's Manual



**Distance
Learning**

Alberta
EDUCATION

Module 4: What Is Agriculture? – Overview

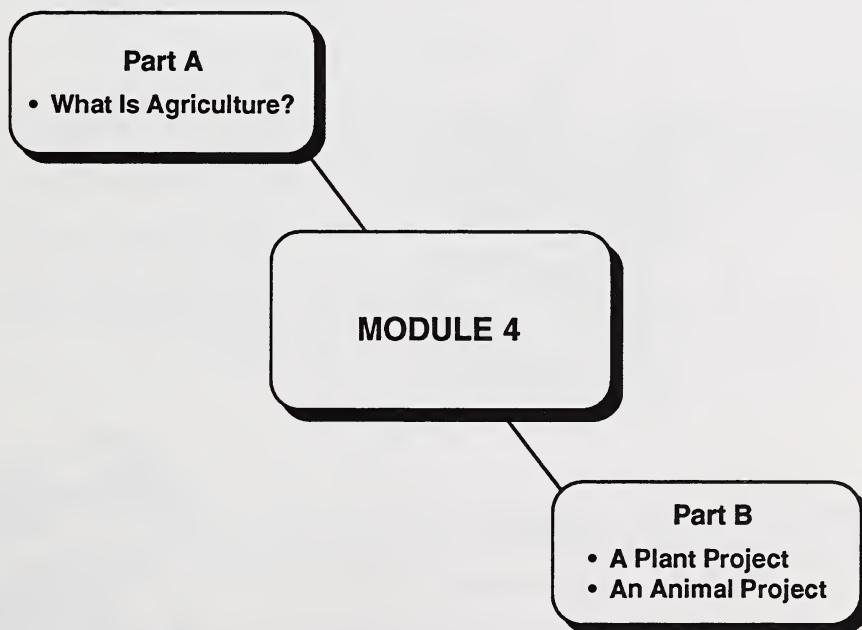
Module 4 is divided into two parts: Part A and Part B.

Part A: *What Is Agriculture?* is to be done only by those students who entered the Agriculture: Land and Life program at the Year Two level. Students who have previously completed Agriculture: Land and Life Year One must do Part B.

The major task of Part A is to answer the question “What Is Agriculture?” The intent is to provide a comprehensive overview of agricultural activity, thereby providing students with a sense of its diversity and scope.

Part B must be completed by students who are taking their second year of the agriculture program. If a student has not completed Agriculture: Land and Life Year One, they must do Part A.

Students who have previously taken Year One of the Agriculture: Land and Life program now have the opportunity to pursue an interest in particular topics during the Year Two program. They are to complete two projects in Part B. Descriptions for a plant project (Project 1) are included in Section 6 of Module 2, and descriptions for an animal project (Project 2) are included in Section 5 of Module 3. The assignments for Part B are included as part of the Module 4 Assignment Booklet.



Students are to do either Part A or Part B, but not both.

Part A

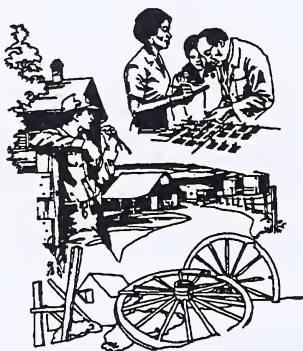
Part A is to be done after the first three modules of this course have been completed. It draws on many of the key ideas and skills covered in the previous modules to provide a comprehensive overview of agricultural activity, and to develop an awareness of agriculture's scope and diversity. The perspective adopted within Part A is that agricultural activity involves much more than the rural farm – the impact of agriculture pervades all of society. The module examines agriculture at a variety of levels, from local to global, and introduces students to Alberta's role as both an importer and exporter of agricultural commodities.

This is how the sections in this module are organized:

Section 1

Agriculture Around Alberta

Discover the diversity of agriculture in Alberta and learn why it is so important to all Albertans.



Section 2

Out of the Past/Into the Future

Travel through time to see how things have changed. Use your imagination to predict how things will be in the future!

Section 3

Feeding the World

See how the world food system operates and how it affects you.



Evaluation

In Part A of this module students will be evaluated on how well they answer the question “What Is Agriculture?” The format for the Module 4: Part A assignments is different from that used in previous modules. It is important for both students and learning facilitators to read the Module 4 Assignment Booklet before starting the Student Module Booklet for Part A of Module 4. This will help students decide on the type of presentation they would like to make, and determine, with the aid of the learning facilitator, if their presentation choice is possible in their particular circumstances. Once the presentation format has been chosen, students can then keep their eyes (and ears) open for worthwhile items while doing the activities in the Student Module Booklet.

The student’s successful completion of all assignments will depend on the experience obtained while doing the various activities. Many choices of activities have been provided so that students have some control over their own learning.

The following distribution of marks is suggested in determining the student’s final mark for Part A of this module.

Section 1 Assignment	30%
Section 2 Assignment	25%
Section 3 Assignment	25%
Section 4 Assignment	20%

TOTAL 100%

Although the value of each module towards the final grading for the Agriculture: Land and Life Year Two course is the decision of the classroom teacher, it is suggested that Module 4: Part A be worth 25% of the total final grade, based on an equal weighting of the four modules in this course.

Materials Needed For Module 4: Part A

The materials required will depend on the format chosen by the student to complete Part A. In order to assist students effectively in their study of this course, it may be helpful to preview Part A. This will give you an idea as to how the topics are developed – it will also give you an overview of the materials needed.

Media

To obtain the videotape resources for this module, contact either your regional media centre or the ACCESS Network. The following three video programs are suggested if students use the optional media learning pathways in Module 4: Part A:

- *Alberta: A Good Place for Agriculture*
- *Careers in Agriculture*
- *The Reason Why*

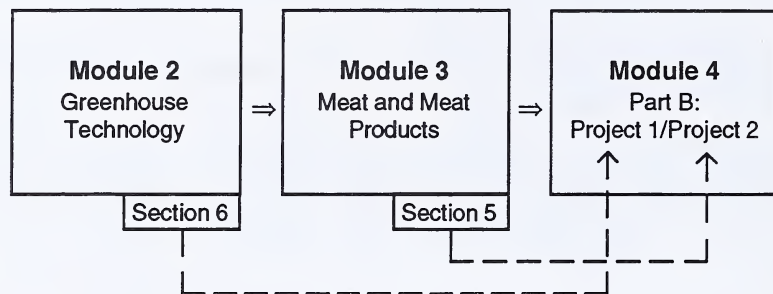
Note: If students do not use the videotape resources, they can still complete this module by following the Student Module Booklet.

Part B: Project 1/Project 2

Part B consists of two projects:

- Project 1: A Plant Project
- Project 2: An Animal Project

Since the plant and animal projects need to be done over a period of time, the plant project instructions are located in Section 6 of Module 2, and the instructions for the animal project are located in Section 5 of Module 3. However, the assignments for both projects are located in the Module 4 Assignment Booklet: Part B. This allows students time to pursue project work while completing other activities in the course.



Evaluation

In Part B of this module students will be evaluated on how well they complete the assignments for their projects. Project 1: A Plant Project consists of five assignments, while Project 2: An Animal Project consists of six assignments. The total value of the assignments for Projects 1 and 2 is 100 marks. For those students who are doing Part B, both the plant project and the animal project must be completed.

A successful completion of all assignments will depend on the experiences students obtained while doing the various activities. Many choices of activities have been provided so students can choose projects in which they are interested. This means that the type of projects students select will vary and, as a result, not all the activities in Section 6 of Module 2 or in Section 5 of Module 3 will be critical to the completion of any one individual project. The activities in Section 6 of Module 2 and in Section 5 of Module 3 are included to assist students with the planning and completion of assignments regarding the plant and animal projects in the Module 4 Assignment Booklet.

To ensure that student choices of projects and goals can be achieved, students will discuss their project plans with the learning facilitator. Therefore, it is important for both students and learning facilitators to read over the activities in Section 6 of Module 2 and Section 5 of Module 3, along with the assignments for the projects in Part B of the Module 4 Assignment Booklet.

The following distribution of marks is suggested in determining final marks for Part B of Module 4.

Project 1:	Assignment 1	5%
	Assignment 2	5%
	Assignment 3	15 or 5%
	Assignment 4	20 or 30%
	Assignment 5	5%
 Project 2:	Assignment 1	5%
	Assignment 2	5%
	Assignment 3	10%
	Assignment 4	15%
	Assignment 5	10%
	Assignment 6	5%
Total		100%

Although the value of each module for the Agriculture: Land and Life Year Two course is the decision of the classroom teacher, it is suggested that Module 4: Part B be worth 25% of the total final grade, based on an equal weighting of the four modules in this course.

Materials Needed for Module 4: Part B

Materials required will depend on what projects are chosen. In order to effectively assist students in their choice of projects, it may be helpful to preview the information in Section 6 of Module 2 for the plant project and in Section 5 of Module 3 for the animal project, as well as the assignments in Part B of the Module 4 Assignment Booklet. This will give you an idea as to how the topics in the projects are developed, and will provide you with an overview of the materials needed for the various projects.

Part A: What Is Agriculture?

Part A of Module 4 is intended to integrate the concepts, information, and experiences from activities and assignments in previous modules.

The following activities and assignments will extend the students' appreciation for the diversity and scope of agricultural activities in Alberta, Canada, and around the globe.

Section 1: Agriculture Around Alberta

In this section students will discover the diversity of agriculture in Alberta and learn why it is so important to all Albertans.

Section 1: Activity 1

Students are to do either Part A or Part B, or both if they wish.

Part A

Watch the videotape *Alberta: A Good Place for Agriculture*.

Part B

Look at the following map of Alberta. Read about the places and the many activities that occur in the province. Some of these are also mentioned in the videotape.

The map referred to is located in the Student Module Booklet. From watching the videotape or looking at the map of Alberta, students are to make notes about the things or places that interest them. As the learning facilitator, you may wish to discuss what agricultural activities occur in the student's locale, and how these activities compare to the diversity and importance of agricultural activities that take place in other parts of the province.

Check to see if the students have made notes to themselves about the things or places that interest them. This may help them complete the assignments for Module 4: Part A.

Section 1: Activity 2

Look at the pictures for this activity. Identify the main activity that is taking place in each picture, and write a caption for each photograph. Other module booklets may help you!

The following are a few possible captions. They are listed in the order in which the pictures occur.

- *Food production begins on the farm.*
- *Even animals need lunch!*
- *The open range has been replaced by the feedlot.*
- *Pork is big business in Alberta.*
- *Modern feeds are not just grown – they are processed.*
- *Food processing is an industry that depends on farming.*
- *Processing plays an important role in preparing Alberta's food products.*
- *Some food is sold directly by farmers.*
- *Your table is the last step!*
- *People keep the farm equipment working.*
- *Animals have to be kept healthy.*
- *Farm equipment for sale – any bids?*

Section 1: Activity 3

1. Use all the available information sources you can find to fill in the following table. Find a town or city in Alberta that would be likely to produce and process each food that is part of the following fast food meal.

Hint: Many answers can be found on the map for Activity 1. Look in the other modules as well. You may also use communities that have not been mentioned in this course.

Food	Could Be Produced At	Could Be Processed At
hamburger (beef or pork)		
cheese		
lettuce		
tomato and cucumbers		
bun (wheat)		
egg		
oil (canola)		
french fries (potatoes)		
milk		
sugar		

Answers for this question will vary according to the students' locale. Discuss unusual or unlikely answers with the students. Give praise and recognition to students for identifying locations for the production and processing of food.

- Country living is enjoyed by people from farms, towns, and cities. Which rural activities do you enjoy or participate in?

Answers will vary.

Section 1: Activity 4

- Find your own location on the Agroclimatic Map (in the Student Module Booklet). Describe the growing conditions in your area.

Answers will vary but should include information on the area's moisture, temperature, and the length of the growing season.

2. Which area has the best climate for agriculture in the province? Why?

Discuss the answer with the student after comparing the student's answer with the information given on the Agroclimatic Map.

The crops used as a basis for this map are grains and oilseeds. Otherwise, answers would vary depending on the type of agriculture being considered. For instance, crops like corn grow better in southern Alberta, while different varieties of market vegetables also have different growing season requirements.

3. What major climatic factor limits crop production in southern Alberta?

A lack of moisture is the major climatic factor that limits crop production in southern Alberta.

4. What is the main limiting factor in the northern part of the province?

Cool temperatures and short growing seasons limit crop production in northern Alberta.

Section 1: Activity 5

1. Describe the climate and vegetation in your own area. Use the maps on previous pages of this section for clues.

Answers will vary, but should be similar to the following:

We have adequate moisture in an average year, and at least 100 frost-free days. There are gently rolling hills with some trees (aspens) in the lower areas and along creeks. Crops grown include wheat, barley, and canola.

2. What type of soil is in your region? Use the soils map and the pictures on the previous page to guess what is the most common soil type in your area. (Colour is the simplest way to describe your soil, although there are many other important characteristics.)

The simplest way to describe soil is by colour. This is by no means a technical description, but it can be a first step toward understanding the distribution of soil types. Everyone has seen the rich, black soils that are best for growing crops – many students live in these areas. Darker soils generally form in grassed, moderately moist areas. The dark colour of the soil is caused by the amount of organic matter in it. Grey soils are more common below forested areas. Students may infer soil characteristics, or they may describe the actual colour of soils they have seen.

3. Which soil types are found in cultivated areas?

Black, dark brown, some brown (usually for irrigation), and some dark gray soils are used for agriculture.

4. Which soil types are found in areas used for pasture?

Gray soils and brown soils are found in areas used for pasture.

Section 1: Activity 6

Use the graph (in the Student Module Booklet) to answer the following questions.

1. Which two crops earn the most money for Alberta farmers?

The pie graph shows wheat and coarse grains to be the leading crop earners for Alberta farmers.

2. What type of livestock is the most important source of income for farmers?

Cattle and calves are the most important source of livestock income for farmers.

3. What are the top two important uses of agricultural land?

Most important use: *the production of crops for human and animal consumption*

Second most important use: *the grazing of cattle*

Section 1: Follow-up Activities

At this point in the section the activities are normally separated into two strands: Extra Help and Enrichment. Since the activities in this module were designed to integrate the information from the previous modules, no Extra Help activities are included. However, students should be encouraged to do at least one of the Enrichment activities for this section.

Enrichment

Enrichment A

Reinforce the idea that everyone has a stake in the food and agriculture system – even if only as a consumer. However, agriculture has come to mean a rewarding occupation or career for many people.

Students are to do either Part A or Part B.

Part A

Watch the videotape *Careers in Agriculture*.

Part B

Interview a person who works in the agriculture or food industry. Ask how they became involved with their particular occupation. Find out what they do and what things they enjoy most about their job. On your own paper, write up your interview as a script, in a question-and-answer format, or make an audiotape of the conversation.

As you discuss the interview, check to ensure that students asked appropriate questions. You may wish to extend the scope of the interview discussion to determine why the students chose to interview who they did, and if they know other people in the same line of work.

If students show an interest in finding out more about a particular career, or any other farm-related occupation, refer them to other sources of information, such as the local district agricultural office or library.

Enrichment B

Students are to do either Part A or Part B, and answer questions 1 to 3.

Part A

Watch the videotape, *The Reason Why*, read the words in Part B, and answer the three questions which follow.

Part B

Read the following information and answer the three questions which follow.

The cost of the food people buy is determined by many factors. For one thing, most foods are bought and sold several times before they are purchased by you, the consumer. Something is added at each stage, and this is shown in the final cost. This increased price is referred to as value added by processing.

The following charts show how the value of food is increased by processing.

For the information contained in the charts, see the charts in the Student Module Booklet.

1. Canada produces grain worth about \$10 billion each year. If 1/10 of this grain (or \$1 billion worth) was used for the production of cereals or bakery products for export, what would be the value of these exports? Use the previous chart (in the Student Module Booklet) for clues.

From the chart, students will see that 1000 t of grain worth \$295 000 becomes 600 t of bakery products worth \$1.35 million after processing. This is an increase in value of 4.6 times! The \$1 billion worth of grain (1/10 of exports) is now worth \$4.6 billion.

2. How many people would be employed if each earned an average of \$30 000 per year? Assume half of the increased value goes for wages.

The increase in value is \$3.6 billion.

$3.6 \text{ billion} \times 1/2 + 30\,000 = 60\,000 \text{ jobs!}$

3. Why is the food processing industry important to Canada's economy?

It employs many people and creates products which can be sold at a higher value than unprocessed products.

Note: The student should now read the Conclusion for this section, then complete the assignment for Section 1 in the Module 4 Assignment Booklet.

The assignments for Module 4: Part A give students a chance to practise what they have learned by communicating their understanding to other people. Students will gather or create, classify, and interpret information about agriculture as they assemble items for their presentations.

All items created or gathered should receive marks, with full marks awarded for appropriate materials presented in a proper context, and accurately described.

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Section 1 Assignment

1. What format will your presentation take? (10)

On the following response page, use an outline to plan your presentation. Include

- a description of the format you plan to use
- a description of the type of items you plan to create or find
- the places you plan to visit
- the places where you plan to look for materials
- the people you will go to for advice or materials

The decision of format is left with the student, in consultation with the learning facilitator. More flexibility is possible in a classroom situation. Non-classroom students should choose a format that can be delivered, faxed, or mailed to a central location for marking.

Check to see that students have access to the resources that will enable them to complete the task (for example, a library, videocamera, film camera, farm magazines, advertising materials, photocopies, or art supplies).

Award marks for the outline according to

- *overall design (4)*
- *resource identification (6)*

2. Find or create at least ten items (such as articles, ads, illustrations, or photographs that display various agricultural activities) to show the diversity of agriculture in Alberta.

Be sure to include the following:

- crops
- livestock
- production on the farm
- processing
- marketing
- supplies and services

List or briefly describe your items on the following response pages. Save the actual items to include as part of your Final Module Assignment. (10)

- *Award one mark for each appropriate selection or creation.*

For each item, write at least two sentences to state how and why it is important to the overall picture of Alberta's agriculture. (10)

- *Award one mark for explaining each item and for telling how it is part of the overall picture of agriculture in Alberta.*

Section 2: Out of the Past/Into the Future

In this section students will

- discover how farmers of the past were similar to farmers of today
- examine changes in agriculture from the past to the present
- examine some of the problems these changes have caused
- discover the reasons behind the growth of the food processing industry
- make predictions about agriculture in the future

Section 2: Activity 1

Students are to do either Part A or Part B.

Part A

Interview a grandparent or someone else who can relate agricultural stories from 50 years ago. Include the questions that follow (in Part B), and some of your own questions, as part of your interview.

Part B

Read about early life on the farm. You will find many personal accounts in the following sources:

- local histories
- stories and novels about the lives of early pioneers
- Alberta Heritage Series readers, published in 1979 by Alberta Education. They include
 - “The Composite Pioneer,” an essay by Dorothy Kamen-Kaye in *Road to Yesterday*, pages 166-172.
 - “Not a Penny in the World” by Barry Broadfoot in *Western Profiles*, pages 263-267.

These resources will give you information and personal accounts to help you find answers to the following questions. Record your answers as if you are interviewing someone from the past.

Students will record their answers to the following questions on paper, or on an audiotape.

- What did people expect from farm life? What did they see as important for “good living?”

Most people would reply that a good harvest was essential. Other expectations would vary depending on the type of farm, and individual preferences.

- What kind of machinery and technology did they have on the farm?

Answers will vary depending on the type of farm, but compared to current farm machinery, the equipment was smaller (it may have been horse-drawn), less complex, and had few technological features. Many of the tasks now done by farm machinery depended on manual labour.

- How many people were involved at harvest time? Where did they all come from? Where did they go after the harvest?

Seasonal farm workers were common on farms a generation ago. Demands for higher wages, farm mechanization, and increased efficiency have eliminated many jobs.

- What was used for power on the farm? Was there electricity? Gasoline powered tractors? Natural gas for heat?

Electrical power is now essential to run farm equipment and household appliances. Not that long ago, the same tasks were performed manually and power was from human hands. Before gas-powered equipment became commonplace on the farm, animals were used for power. Heat was usually obtained from burning wood or coal.

- Who helped the farmer out? What kinds of businesses did farmers depend on? Did farmers get much government help?

As farming becomes more complex, farmers seek help from a variety of sources including governments, banks, dealerships, and training courses. Financial assistance to farmers has increased dramatically in recent years.

- How was food preserved and prevented from spoiling?

Home canning and other forms of home preserving were much more common in the past than they are today. Root cellars were often used to store produce such as potatoes.

Section 2: Activity 2

The pictures in this activity show some of the differences between farming in the past and the present. Describe the main differences between each of the following four pairs of pictures (shown in the Student Module Booklet).

1. What has changed?

Less human time and energy is now required. Fewer people are needed to harvest a crop.

2. What has changed?

Machine power has replaced animal and human power – machinery covers ground quickly and can accomplish large tasks.

3. What has changed?

The size of livestock operations has increased to produce more at a lower cost. Today's farms must feed many more people than did farms of the past.

4. What has changed?

Farming methods have changed. In this case spraying has replaced tillage as a means of controlling weeds. Summerfallowing is becoming less common.

Section 2: Activity 3

1. Which of the following suggestions involve conservation farming methods? Mark with a C.

Which of the following are methods for increasing crop production?

Mark with a P.

Note: Some of these suggestions may qualify to be marked with both a C and a P.

Comments are included with the following answers as to why the suggestions are marked with a C or a P (or both).

a. Decrease summerfallow.

P – will produce a crop each year

C – will reduce erosion and lose less organic matter

b. Clear bush to make more farmland.

P – will increase the land available for farming

c. Increase the use of chemicals.

P – will increase crop yields

d. Experiment with higher-yielding crops.

P – will produce higher crop yields

e. Practise crop rotation for pest and weed control.

P – crops will be less subject to pest outbreaks

C – reduces the need for chemicals

- f. Practise conservation tillage.
C – reduces erosion
 - g. Plant nitrogen-fixing crops called legumes.
P – increases crop yields
C – less fertilizer required
 - h. Take marginal land out of grain production and seed it to grass.
C – reduces erosion
 - i. Drain sloughs to increase the available farmland.
P – increases the amount of farmland and makes operations more efficient
2. Do you think it is possible to increase production and still preserve the earth's environment and soil? Explain.

The answers to question 1 could serve as a guide for this question. Students should answer "Yes." If people are careful to grow approved varieties of crops, practise crop rotation, use chemicals wisely, and use other proper farming practises, it is possible to increase production and still preserve the earth's environment and soil.

3. If it is not possible, which (increasing production or preserving the environment) do you think is more important? Why?

Conserving resources and looking after the environment will ensure future production.

Section 2: Activity 4

1. What problem is the farmer experiencing in the previous cartoon (in the Student Module Booklet)?

The farmer is borrowing money to increase the size of his operation, and to make the farm more efficient. Both are worthwhile objectives. However, as the farm grows so do costs – the farmer continues to borrow to stay ahead.

2. What do you think the farmer should do? Why?

The farmer could look at other ways to solve his problems rather than borrowing money, such as cutting expenses and looking for ways (such as growing different crops) to increase income.

3. If you were a bank manager, how would you decide whether to loan a farmer or food processor money to expand his or her operations?

First of all, will the borrower be able to pay the money back? This will only happen if his or her earnings rise faster than expenses after the operation is expanded.

Section 2: Activity 5

It will soon be possible to create foods in the laboratory that are as good as anything you can grow!
Do you believe this?

Try your luck at designing a fictional food. Use the following as a guide.

Product Name:

Taste:

Texture:

Colour:

To be made from:

Describe the process that you would use to make it:

Package Design:

Answers will vary. Look for originality, usefulness, and a marketing strategy. This is a good chance for students to use their imaginations!

Section 2: Follow-up Activities

At this point in the section the activities are normally separated into two strands: Extra Help and Enrichment. Since the activities in this module were designed to integrate the information from the previous modules, no Extra Help activities are included. However, students should be encouraged to do at least one of the Enrichment activities for this section.

Enrichment

Enrichment A

Students are to do either Part A or Part B, and answer questions 1 to 4 that follow Part B.

Part A

Watch the videotape titled *The Reason Why*.

Part B

Read the videotape summary (in the Student Module Booklet).

1. Find out how much your family spends on food each month. Calculate the total amount your family spends on food each year.

Answers will vary. A sample calculation follows.

$$\$500/\text{month} \times 12 \text{ months} = \$6000/\text{year}$$

2. List some of the other things that you can buy with this money.

Answers will vary.

3. What items would you do without if food prices doubled?

Answers will vary.

4. Should Canadians pay more for their food? Explain your answer.

Answers will vary. However, higher prices might permit farmers to put more thought and effort toward conservation. Higher prices might also encourage more research, development, and local production of items that must now be imported.

Enrichment B

Describe what the predicted temperature and precipitation changes could mean for agriculture in Alberta. What do you think the effects will be?

Answers will vary. Dryness in the south will mean a greater need for irrigation. Warmer temperatures in the northern part of the province will permit farming if sufficient moisture and suitable soil are available.

Note: The student should now read the Conclusion for this section, then complete the assignment for Section 2 in the Module 4 Assignment Booklet.

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Section 2 Assignment

1. Find or create at least three items showing agriculture in the past, and at least two more dealing with agriculture in the future.

List or briefly describe your items on the following response page. Save the actual items to include as part of your Final Module Assignment. (5)

- *Award one mark for each appropriate selection or creation.*

For each item, describe its significance to the history or future of agriculture. (5)

- *Award one mark for describing the significance of each item to the history or future of agriculture.*

2. Find or create at least five items relating to the resources used in agriculture. For example, you may wish to find or create items relating to such resources as soil, water, and energy.

List or briefly describe your items on the following response page. Save the actual items to include as part of your Final Module Assignment. (5)

- *Award one mark for each appropriate selection or creation.*

For each item, tell why the resource is important to agriculture. (10)

- *Award two marks for telling why the resource shown in each item is important to agriculture.*

Section 3: Feeding the World

In this section students will see how the world food system operates and how it affects them. They will

- examine a variety of foods, and compare diets with other countries
- examine international trade in food and food products
- identify issues in world food production and trade
- analyse a problem of food distribution

Section 3: Activity 1

Students are to do either Part A or Part B.

Part A

Visit a restaurant that features food from another country. Sample items from the menu. Describe your meal in the space following Part B.

Part B

Prepare one or more dishes from another country. Many ideas can be found in recipe books. Describe your meal in the following space.

Answers will vary. Encourage students to share their experiences with a friend.

Extension

Research the country you chose in Part A or B to discover the agricultural products for which the country is noted. Which products are a part of the dish you prepared?

Not all students will do the Extension activity. For those who do the activity, the answers will vary depending on what country the recipe is from, as well as what ingredients are used.

Section 3: Activity 2

Answer the following questions using the previous graph (in the Student Module Booklet), and your own ideas.

1. What are the top agricultural products that Canada imports?

Fruits and nuts are Canada's largest agricultural imports.

2. Why do Canadians import the agricultural products noted in question 1?

Canada imports fruits, and nuts which do not grow well in this climate, or those which are only available from other countries during Canada's winter season.

3. Some of the products imported are also produced in Canada. Why do you think Canada imports food that is already grown in this country?

Many countries can produce these products for a lower cost than Canada. The crops may be fresh and seasonal (such as apples or grapes) and available from the Southern Hemisphere when they are unavailable in Canada.

4. Recall your meal from Activity 1. List all of the ingredients that might come from another country. Then list the ingredients that are produced in Canada.

Answers will vary.

Section 3: Activity 3

Use the previous graphs (in the Student Module Booklet) to answer the following questions.

1. Where did most of Alberta's agricultural products go in 1987 – to other provinces or to other countries?

Most of Alberta's agricultural exports went to other countries – \$1.8 billion in 1987.

2. What was Alberta's most important agricultural export?

Wheat was Alberta's most important agricultural export.

3. Which two areas of the world were Alberta's most important foreign destinations for agricultural exports?

Asia and North America (mainly the United States) were Alberta's two most important destinations for agricultural exports.

4. What was Canada's most important agricultural export?

Wheat was Canada's most important agricultural export.

5. Which area was Canada's most important destination for agricultural products?

North America (mainly the United States) was the leading importer of Canada's agricultural products.

6. What percentage of Canada's total agricultural exports came from Alberta?

In 1987, \$1.8 billion worth of exports were sent from Alberta to other countries, versus \$8.9 billion for Canada. This indicates that approximately 20% of Canada's agricultural exports were from Alberta.

Section 3: Activity 4

1. Look at Canada's agricultural exports and imports for 1987 (from Activity 3). Did Canada export more agricultural products than it imported?

In 1987, Canada had a trade surplus of \$2.1 billion in agricultural products. Canada exported commodities worth \$8.9 billion and imported commodities worth \$6.8 billion.

2. How does this benefit Canada's economy?

Exports bring money into the country to develop industries and provide wages for workers. Many related businesses also benefit from agricultural exports.

3. Why do you think there is such variation in meat consumption between different areas of the world?

The most important reason is cost – meat is an expensive food. In poorer regions people eat more staple foods because they are more plentiful and affordable than foods made from animals.

Section 3: Activity 5

Will the people of the world have enough food in the future?

That depends. People have been smart enough to solve many problems of production, processing, and transportation. But a sustainable food system for the future world must have other goals that include the following:

- The soil, water, and all natural resources must be treated with great care.
- Each country has to be helped to grow the food needed for its people.
Much can still be done to improve crop yields, storage, and transportation.
- People have to work together to solve the political problems that cause people to go hungry.

What would you like to do to help? How would you go about it?

Answers will vary but may include

- *improving crop yields, storage, and transportation in other countries so the people can feed themselves*
- *working for the conservation of natural resources used to produce food*
- *researching new crop varieties that will grow in harsh conditions*
- *using public opinion to help solve the political problems that keep people hungry*

Note: The student should now read the Conclusion for this section, and the Module Summary, then complete the assignment for Section 3 and the Final Module Assignment in the Module 4 Assignment Booklet.

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Section 3 Assignment

1. Find or create at least two items which show the worldwide side of the food system.

List or briefly describe your items on the following response page. Save the actual items to include as part of your Final Module Assignment. (2)

- *Award one mark (to a maximum of two marks) for each appropriate selection or creation.*

For each item, explain what the item shows about the world food systems. (4)

- *Award two marks (to a maximum of four marks) for describing what each item shows about the worldwide food system.*

2. Find or create at least two items which show some of the food problems that face people in other countries.

List or briefly describe your items on the following response page. Save the actual items to include as part of your Final Module Assignment. (2)

- *Award one mark (to a maximum of two marks) for each appropriate selection or creation.*

For each item, describe the problem. (4)

- *Award two marks (to a maximum of four marks) for describing the problem shown by each item.*

Suggest a reason for these problems in your description. (2)

- *Award one mark (to a maximum of two marks) for suggesting a reason for the problem shown by each item.*

3. Find or create at least five items that interest you about careers in agriculture.

List your items on the response page. Save the actual items to include as part of your Final Module Assignment. (5)

- *Award one mark (to a maximum of five marks) for each appropriate selection or creation.*

Describe each career you named. (6)

- *Award two marks (to a maximum of six marks) for describing each career.*

Final Module Assignment

1. By now you should have created or gathered all of the items you intend to use for your presentation in this Final Module Assignment. Assignments 1, 2, and 3 in this booklet should help you review and organize the main ideas needed for your presentation: "What Is Agriculture?"

Prepare your final presentation. Marks will be given for creativity (5), completeness (5), quality of presentation (5), and quality of information (5).

Some suggestions that may help you organize your final presentation are the following:

- Use large titles to introduce each topic.
- Centre drawings/items around text that explains how they are related.
- Videotape (or audiotape) a personal description of your program if this is the format you have chosen for your presentation.

Note: Several response pages have been included if you wish to use them. However, depending on the format you have chosen for your presentation, you may need to use your own poster paper, audiotape, videotape, or whatever other materials are required for your presentation. Remember that the format you choose for your presentation must be able to be delivered, faxed, or mailed for marking.

The final presentations prepared by the students will vary depending on the format chosen and the items created or gathered. Check to see how well the instructions were followed. Award marks as follows:

- *five marks for overall creativity*
 - *five marks for completeness*
 - *five marks for quality of presentation*
 - *five marks for quality of information*
2. **Bonus!** Earn five extra marks by showing your creation to someone, and having them fill out the attached evaluation form. (It is possible to earn 105% on these module assignments!)

Award a bonus five marks for a signed evaluation form and comments on the presentation.

NOTE: 1. A final grading for Module 4 can now be determined for those students who completed Part A.

2. **The student should now have completed and been assigned gradings for all four modules of this course. A final grading for Agriculture: Land and Life Year Two should now be determined.**

Part B: Project 1/Project 2

Part B is to be done by those students who have previously completed Agriculture: Land And Life Year One. If your first enrolment in the Agriculture: Land and Life program is at the Year Two level, then you must do Part A instead of Part B in this Module 4 Assignment Booklet.

Part B contains assignments for two projects:

- Project 1: A Plant Project
- Project 2: An Animal Project

The instructions for completing the plant project are included in Section 6 of Module 2: *Greenhouse Technology*.

For answers to the plant project activities, see Section 6: A Plant Project in the Learning Facilitator's Manual (Module 2).

The instructions for completing the animal project are included in Section 5 of Module 3: *Meat and Meat Products*.

For answers to the animal project activities, see Section 5: An Animal Project in the Learning Facilitator's Manual (Module 3).

Project 1: A Plant Project consists of five assignments, while Project 2: An animal Project consists of six assignments. The total value of the assignments for project 1 and project 2 is 100 marks. Both Part B projects must be completed.

Note: The answers to the assignments for Part B are found in Section 6: A Plant Project in the Learning Facilitator's Manual (Module 2) and in Section 5: An Animal Project in the Learning Facilitator's Manual (Module 3). However, the answers are also reprinted here for your convenience.

Project 1: A Plant Project

5

Part B: Project 1: Assignment 1

1. Which plant project do you plan to do? Describe your project. (2)

This should be a summary of the project.

2. State your goals. What do you hope to achieve with this project? (3)

Answers will vary.

5

Part B: Project 1: Assignment 2

1. List all reference books that you plan to use on this project. Add the author, title, publisher, and date of publication. Follow with a one-line description of the content.

Answers will vary. Check for complete descriptions.

2. List any people or clubs that might provide you with help and information.

Answers will vary. Check for complete descriptions.

3. Add new sources of information to your list as you find them.

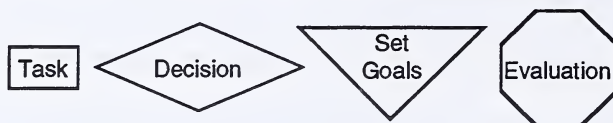
Answers will vary. Check for complete descriptions of resources.

Part B: Project 1: Assignment 3

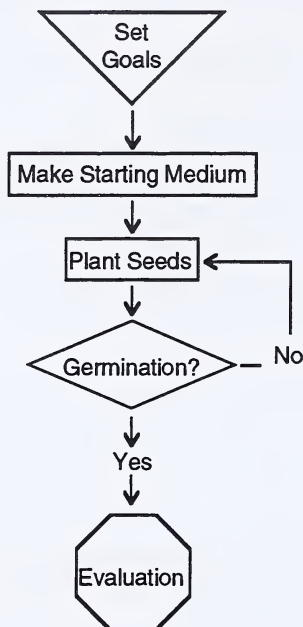
Students are to do either question 1 or question 2. Question 1 is to be done by students who are growing plants. Question 2 is to be done by students who are doing a Crop Research Project.

15

1. a. If you are growing plants, make a flow chart that shows all the tasks you must do in order to complete your project. Use words or the following symbols in your chart: (10)



The following is an example of a simple flowchart.



Answers will vary. Check for a logical sequence of operations. Students may use the example of the simple flow chart as a guide.

- b. Describe the environmental factors that you will control in order to grow your plants. If you have more than one group of plants, describe the conditions for each group. (5)

Answers will vary with the choices of plants and the nature of the central activity.

5

2. Prepare an outline for your report on a special crop, or a plant that is grown in a controlled environment. See the description of the Crop Research Project in the Student Module Booklet for a list of information that must be included in your report. (5)

The outline should mention the topics that will be reported on later. This includes the origin and history of the crop (or plant), where and how it is grown, the environment needed for its growth, and how the crop is processed to make other products.

Part B: Project 1: Assignment 4

Students are to do either question 1 or question 2. Question 1 is for students who are growing plants. Question 2 is for students who are doing a Crop Research Project.

20

1. a. Keep a record of plant growth and growing conditions for your plants. Set up a journal on the response pages. Use a separate page for each type of plant or growing condition. You may use written descriptions to record the information in your journal, or the Plant Journal in Module 2 as an example of how to set up your pages. (15)

Review the student records for a full description of growing conditions, and at least ten entries where students made some sorts of observations.

- b. Prepare a properly labelled graph that compares some aspect of your data. Write a brief description of your graph's purpose. (5)

Answers will vary. Check for

- *proper plotting and labelling*
- *a description of the graph's purpose*

30

2. a. Prepare a written report on your plant or crop. Be sure to use your outline from Assignment 3 as a guide to help organize your information. Be sure to include

- the origin and history of plant cultivation (3)
- the environment required for growth (3)
- where it is grown (2)
- how it is grown (3)
- how it is sold (3)
- how it is processed (3)
- what food or other products are made from it (3)
- other information of interest to you (5)

Check to see that answers are supplied for each of the main components suggested in the question. Give one mark for each point in the answer, up to the maximum suggested for each component.

- b. Prepare a properly labelled graph that compares some aspect of your information. For example, you may want to compare the consumption of similar foods between regions, or the production of similar foods between countries. Write a brief description of your graph's purpose. (5)

Answers will vary. Check for

- *proper plotting and labelling*
- *a description of the graph's purpose*

5

Part B: Project 1: Assignment 5

Evaluate the success of your project. Were your original goals achieved?

Explain why or why not. (5)

Answers will vary. Some projects may not be completed due to a lack of time, the death of the plants, or other reasons. This does not mean that the project is not a success – if students can explain what went wrong, they will have learned something.

Note: All the assignments for the plant project and the animal project (which is described in Section 5 of Module 3) need to be completed to meet the requirements for Module 4.

Project 2: An Animal Project

5

Part B: Project 2: Assignment 1

1. Describe your animal project. (2)

a. What animal do you plan to raise or study?

Answers will vary.

b. Why did you select this particular animal or breed?

Answers will vary. The animal should, however, provide humans with some sort of product or service, or be a type of wildlife in a habitat that is influenced by human activity.

2. State your goals. What do you hope to achieve with this project? (3)

Answers will vary. Look for specific learning objectives.

5

Part B: Project 2: Assignment 2

1. List all reference books that you plan to use in this project. Add the author, title, publisher, and date of publication. Follow with a one-line description of the content.

2. List any people or clubs that might provide you with help and information.

3. Add new sources of information to your list as you find them.

Answers for this assignment will vary. Encourage students to use a variety of sources.

Part B: Project 2: Assignment 3

Students should answer only the questions for Project A, B, C, or D, depending on the project they are doing.

Project A

1. Describe the housing for your animal. Use a diagram if you wish. (5)

Answers will vary. Award marks for a considerate design.

2. Outline where you will obtain feed for your animal. Describe the essential nutrients in its normal diet. (5)

Answers will vary. See also Section 2: "Animal Nutrition" in Activity 2 of the Module 3 Student Module Booklet. Award marks for a balanced diet.

Project B

1. Describe the normal type of housing required to raise this animal. Use a diagram if you wish. (5)

Answers will vary. Award marks for a considerate design.

2. Outline the sources of essential nutrients in a normal diet for this animal. (5)

Answers will vary. See also Section 2: "Animal Nutrition" in Activity 2 of the Module 3 Student Module Booklet. Award marks for a balanced diet.

Project C

1. Describe the ideal habitat for your animal. Use a diagram if you wish. (5)

OR

Describe a part of your farm or acreage that could be a suitable habitat for the animal you have chosen. (5)

Answers will vary. Award marks for a thorough description.

2. How will this habitat provide suitable shelter and protection from predators? (2)

Answers will vary. Award marks for a considerate response that discusses both protection and predators.

- Describe the normal diet of your animal. How will the habitat provide all the essential nutrients that the animal requires? (3)

Answers will vary. Herbivores require wild plants, such as forages, and tender shoots from trees. Carnivores are at the top of the food chain, and will receive their nutrients from the plant eaters.

Project D

- Outline the ideal habitat for your animal. Use a drawing or picture if you wish. (5)

OR

Draw a map of a trap line that you plan to operate. Identify and describe the habitats that are suitable for this animal. (5)

Answers will vary. Award marks for a thorough description.

- Describe the shelter that this animal uses as a home. How does it shelter the animal and protect it from predators? (2)

Answers will vary. Award marks for a thorough description.

- Describe the normal diet of your animal. How will the habitat provide the essential nutrients that the animal requires? (3)

Most fur-bearing animals are carnivores at the top of the food chain. They will receive their nutrients from the plant eaters that they consume.

15

Part B: Project 2: Assignment 4

Students should answer only the questions for Project A, B, C, or D, depending on the project they are doing.

Project A or Project B

Describe how you (or other people) will manage the following aspects of your animal's life:

(3 marks each)

- Your animal's normal behaviour
- Prevention of the common diseases

3. Control of parasites
4. Cleaning (How often? What will you do with wastes?)
5. Grooming

Answers will vary for questions 1 to 5. Read “Signs of Good Health,” “Preventing Disease,” and “Wildlife Management” in Section 5: Activity 4 of the Module 3 Student Module Booklet.

Project C or Project D

1. Complete a wildlife survey in an area that you would like to improve. Include all of the animals that you can identify, not just the animal that is the topic of your project. If your animal lives in several separate areas, visit each area to estimate the number of wild animals at each location. Describe how you did your survey, then outline your survey results in table form on the following response page. Use the following table only as a guide. (5)

Estimated Number of Animals			
Animals	Area 1 or Day 1	Area 2 or Day 2	Area 3 or Day 3

Answers will vary. Read “Counting the Animals” in Section 5: Activity 4 of the Module 3 Student Module Booklet for general background information. A chart similar to the one shown above may contain the answer. Determine how reasonable the survey is.

2. Explain how you might improve your animal’s habitat to increase the population. Your ideas might involve improving the housing or food supply, creating nesting areas, improving protection against predators, controlling predators, and importing animals from another area, hatchery, or game ranch. (10)

Use a diagram to illustrate your plans, or include photographs of any work actually completed.

Answers will vary. Read “Improving Habitats” in Section 5: Activity 4 of the Module 3 Student Module Booklet for some general ideas.

Part B: Project 2: Assignment 5

Students should answer only the questions that apply to their project.

Project A

1. Describe how your animal will be used to provide a product or service. (2)

Answers will vary.

2. Describe any special medication, grooming, or training that is required before you can market your animal. (5)

Answers will vary.

3. Prepare a graph which compares some aspect of your animal. For example, note the weight gain or growth over a period of time, the time spent caring for the animal each week, or the amount of feed consumed over a given time. (3)

Answers will vary. Check for the appropriate demonstration of a relationship.

Project B

1. Describe how your animal will be used to provide a product or service. (5)

Answers will vary.

2. Outline how the animal will be trained, sold, and processed. (3)

Answers will vary.

3. Include a graph which compares some aspect of your data. For example, compare the percentage of your animal in the general livestock population, or the uses of the animal for different purposes. (2)

Answers will vary. Check for the appropriate demonstration of a relationship.

Project C

1. Describe how improvements in wildlife habitats can benefit people as well as animals. (2)

Habitats such as shelterbelts can also protect livestock and people. Beaver dams can act as a source of water for emergencies. Cover crops and shelterbelts can prevent erosion.

- Investigate and report on how wildlife organizations, governments, or individuals help to manage and preserve wildlife habitats. (5)

Answers will vary. Information is available from Ducks Unlimited and Fish and Wildlife offices. These organizations promote the interests of wildlife by stressing the benefits of wildlife to landowners.

- Include a graph which compares an aspect of your data. For example, compare the number of animals or birds counted before and after your improvements, the number of animals in different areas, or the proportion of your farm that is used for various purposes, including wildlife habitats. (3)

Answers will vary. Check for the appropriate demonstration of a relationship.

Project D

- Describe how humane trapping methods can be used to trap your animal. (5)

Answers will vary. The emphasis in this project should be on humane methods of trapping.

- Describe the methods used to preserve a pelt from your animal. (3)

Look for a description of skinning, forming, fleshing, and drying.

- Include a graph which compares one aspect of your data. For example, note the number of animals harvested in Canada or Alberta over several years, or the number of trapping licences issued over several years. (2)

Answers will vary. Check for the appropriate demonstration of a relationship.

5

Part B: Project 2: Assignment 6

- Evaluate the success of your project. Were your original goals achieved?

Explain why or why not. (2)

Answers will vary. Students should decide which goals were realized and identify the goals which may be achieved in the future. Finally, they should look at the goals that were not achieved. How well did they do? Have they offered an explanation if something did not go according to plan?

2. Describe a controversial issue that affects your animal. How do you feel about such things as

- confinement-rearing of livestock
- using animals for medical experiments
- using growth hormones to increase rates of weight gain, strength, and endurance
- game ranching – raising wild animals, such as elk, to sell to special markets
- preserving marsh wetlands for waterfowl
- a European ban on the import of fur or fur products
- dangerous dog laws
- cat bylaws (Don't let your cat outdoors without a leash!)

Write about these topics or any other issues that relate to your animal. Be sure to take a stand. Justify your opinion. (3)

Answers will vary.

Note: 1. A final grading for Module 4 can now be determined for those students who completed Part B.

- 2. The students should now have completed and been assigned gradings for all four modules of this course. A final grading for Agriculture: Land and Life Year Two should now be determined.**

This is a course designed in a new distance-learning format, so we are interested in your responses. Your constructive comments will be greatly appreciated so that a future revision may incorporate any necessary improvements.

TEACHER QUESTIONNAIRE FOR AGRICULTURE: YEAR TWO

Teacher's Name _____ Area of Expertise _____

School Name _____ Date _____

Design

1. The modules follow a definite systematic design. Did you find it easy to follow?

☐ Yes ☐ No If no, explain.

2. Did your observations reveal that the students found the design easy to follow?

☐ Yes ☐ No If no, explain.

3. Did you find the Learning Facilitator's Manual helpful?

☐ Yes ☐ No If no, explain.

4. Part of the design involves stating the objectives in student terms. Do you feel this helped the students understand what they were going to learn?

☐ Yes ☐ No If no, explain.

5. The questions in the Module Booklet are to help clarify and reinforce the instructional materials. The answers were placed in the Learning Facilitator's Manual. Did this design prove helpful?

☐ Yes ☐ No If no, explain.

6. Did the Follow-Up Activities prove to be helpful?

☐ Yes ☐ No If no, explain.

7. Were students motivated to try these Follow-Up Activities?

☐ Yes ☐ No If no, give details.

8. Suggestions for video activities are included in the course. Were your students able to use these activities?

☐ Yes ☐ No Comment on the lines below.

9. Were the assignments appropriate?

☐ Yes ☐ No If no, give details.

10. Did you fax assignments?

☐ Yes ☐ No

11. If you did fax, did you get satisfactory results from using this procedure?

☐ Yes ☐ No If no, give details.

Instruction

1. Did you find the instruction clear?

☐ Yes ☐ No If no, give details.

2. Did your observations reveal that the students found the instruction interesting?

☐ Yes ☐ No If no, give details.

3. Did you find the instruction adequate?

☐ Yes ☐ No If no, give details.

4. Was the reading level appropriate?

☐ Yes ☐ No If no, give details.

5. Was the workload adequate?

☐ Yes ☐ No If no, give details.

6. Was the content accurate and current?

☐ Yes ☐ No If no, give details.

7. Did the content flow consistently and logically?

☐ Yes ☐ No If no, give details.

8. Was the transition between booklets smooth?

☐ Yes ☐ No If no, give details.

9. Was the transition between print and media smooth?

☐ Yes ☐ No If no, give details.

Additional Comments

When you have completed this questionnaire,
please mail it to the following address:

Design Department
Alberta Distance Learning Centre
Box 4000
Barrhead, Alberta
T0G 2P0



L.R.D.C.
Producer

Agriculture Year 2

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FIRST EDITION
1992